REPORT RESUMES

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AN ANALYSIS OF THE EFFECT OF THE HIGH SCHOOL CURRICULUM UPON COLLEGE ACHIEVEMENT.

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THE PRINCIPAL OBJECTIVE OF THIS STUDY WAS TO DETERMINE THE EFFECTS OF 2 DIFFERENT HIGH SCHOOL CURRICULUMS, COLLEGE PREPARATORY AND NONCOLLEGE PREPARATORY, ON COLLEGE ACHIEVEMENT. HIGH SCHOOL TRANSCRIPTS OF 906 ENTERING FRESHMEN, RANKED ON THE BASIS OF THE PERCENTAGE OF COLLEGE PREPARATORY COURSES INCLUDED, WERE DIVIDED AT THE FIRST AND THIRD QUARTILES. GROUP A INCLUDED 228 TRANSCRIPTS WHICH INDICATED AT LEAST 73 PERCENT COLLEGE PREPARATORY COURSES AND GROUP B INCLUDED 226 WHICH INDICATED LESS THAN 59 PERCENT OF SUCH COURSES. COLLEGE GRADE POINT AVERAGES WERE ANALYZED FOR COMBINED AND FOR SEPARATED MALE AND FEMALE SAMPLES FOR EIGHT CONSECUTIVE SEMESTERS OF COLLEGE WITH THE AMERICAN COLLEGE TEST COMPOSITE SCORE AS THE STATISTICAL CONTROL OF ABILITY. ON THE BASIS OF THIS SCORE, GROUP A EXCELLED GROUP B, BUT WHEN SCORES WERE ADJUSTED TO A COMMON MEAN, NO SIGNIFICANT DIFFERENCE EXISTED FOR ACHIEVEMENT, THE COLLEGE ENTERED, OR SEX. AN ANALYSIS OF VARIANCE OF COLLEGE GRADE POINT AVERAGE ON MALE AND FEMALE SUBSAMPLES SHOWED THAT SIGNIFICANT DIFFERENCES OF ABILITY EXISTED BETWEEN THE TWO GROUPS BUT ACHIEVEMENT WAS NOT SIGNIFICANTLY DIFFERENT FOR THE LAST SIX SEMESTERS. THE DATA TENDED TO INDICATE THAT THE HIGH SCHOOL CURRICULUM WAS NOT HIGHLY CRITICAL BUT THAT GENERAL INTELLIGENCE AND NONINTELLECTIVE FACTORS WERE MORE DECISIVE TO COLLEGE ACHIEVEMENT. THE DATA COLLECTION INSTRUMENT, TABULAR DATA, AND A BIBLIOGRAPHY ARE INCLUDED. (EM)

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AN ANALYSIS OF THE EFFECT OF THE HIGH SCHOOL CURRICULUM UPON COLLEGE ACHIEVEMENT

by

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ABSTRACT

Scope and Method of Study: The principal objective of this study was to evaluate the effect of two different high school curricula, college preparatory and non-college preparatory, upon college achievement. Further, the correlation of these two curricula was investigated with relation to the particular college of the university in which the students were enrolled. Separate male and female analyses were conducted to determine whether the factor of sex significantly effected achievement between groups and among colleges.

A complete record of the high school transcript and ACT scores for each of the 906 subjects was secured from the office of the college registrar. Each of these was examined, and the amount of time spent by the student in the different courses was converted to standard Carnegie units. Each transcript was then evaluated, and the results tallied as to the number of Carnegie units in the college preparatory area and the number in the non-college preparatory area. This evaluating included four years of high school work from the ninth through the twelfth grade. The total units of high school credit divided into the number of college preparatory units provided a measure of the high school curriculum background for the student, expressed as a percentage figure. All courses attended by the student were included.

The records were then arranged in rank order, according to the percentage of college preparatory content included in the student's high school curriculum. Divisions were made at the first and third quartiles according to acceptable standards for establishing groups from ordinal data. This division resulted in the establishment of Group A as those students completing 73 percent or more of their high school work in the college preparatory area and of Group B as those students completing 59 percent or less of their high school curriculum in the college preparatory area. All students having the same percentage of college preparatory units as well as the student who was actually on the first and third quartile points were included in the sample. The number of subjects in the study was then established as 228 in Group A and 226 in Group B.

Analyses of covariance of college Grade Point Average were conducted on the combined male and female sample and on separate male-only and female-only samples for eight consecutive semesters of college. The American College Test composite score was employed as the concomitant variable for statistical control of ability in the analysis of covariance. Various supplementary analyses of the basic data were also computed on an *a priori* basis.

Findings and Conclusions: The two groups were highly different in their ability to perform college tasks as measured by the American College Test with Group A excelling over Group B. When the difference in ability was adjusted to a common mean in an analysis of covariance, the achievement of the two Groups was not significantly different. The Group by college interaction values were not significant in the analyses of variance or the analyses of covariance, indicating that achievement was not dependent upon a certain combination of group and college. When ability, as indicated by the American College Test, was adjusted to a common mean among colleges, no significant difference in grade point average was attained by the student because of his selection of a particular college. However, isolated exceptions to the above conclusion were found.

The separate male-only and female-only samples appeared to be from the same population as the combined male - female sample.

Analyses of variance of college grade point average were conducted for the male-only and the female-only subsamples. The results indicated that the first year of college was the most critical concerning the relationship of achievement to high school background. Highly significant differences in ability existed between the two groups; however, achievement was not significantly different for the remaining six semesters.

In summary, the data does not tend to indicate that the high school background is highly critical to college success, but tends to indicate that general intelligence and non-intellective factors are more decisive to college achievement.

Recommendations pointed to the need for additional research in the area of high school background as it may effect the college dropout rate.

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CHAPTER I

THE NATURE OF THE PROBLEM

Introduction

That only a fraction of the total accumulated experience of a culture can be included in a program of formal education has long been conceded. Therefore, one of the most critical concerns in education continues to be that of determining what shall be and what shall not be included in the curriculum at the various levels. The prodigious growth of the population, the violent social change, and the tremendous increase in knowledge have all contributed to the importance of curricular decisions.

Authorities in the field estimate that the amount of knowledge has doubled in the preceeding fifteen years and that it is destined to double again during the next decade. The estimated $20 billion annual expenditure, and the thousands of individuals who are currently involved in research are indicative of the desire for knowledge in today's society. Clark (15) predicts that "Half of what a graduating engineer studies today will be obsolete in ten years." Lloyd Michael (49) adds, "Half of what he will need to know is not yet known by anyone." Educators and others responsible for determining the content of formal education must have broad shoulders, for the decisions they make are most important.

The assumption has been established that society is changing and that man can and should direct these changes toward an even better life for all. The value of the public schools as social institutions capable of effecting and directing change has been increasingly recognized since the beginning of the Social Reconstruction movement, supported by George Counts and Theodore Brameld. It has also been accepted that one of the instruments for the intelligent direction of social change is curriculum content. A postulate has been enacted maintaining that careful selection of this content can build the kinds of knowledge and abilities required to deal intelligently with the multiplicity of problems faced by the youth of a changing society.

It seems that the value of education in America has been taken for granted. It is not uncommon to hear the analogy that a four-year college education today is comparable to a high school education of the previous generation. This supposition is supported by the large amount of time and resources being given over to the discovery of new knowledge. It can also be supported by reviewing the statistics concerning college enrollments. During the past decade student enrollment at the college level has increased two-and-one-half million. It took colleges and universities three hundred twenty years to enroll the first two-and-one-half million students; whereas, it took them only ten years to add the next two-and-one-half million (37). The emphasis on literacy and equal opportunity encourages Americans to be "proeducation," to feel that education merits support. Originally, rugged individualism devalued prolonged study and the contemplative life. It made schooling seem relatively unimportant, for one succeeded through personal qualities of thrift and courage and hard work in the world of action. The American value system continues to stress the importance of individual achievement, but in a less "rugged" conception than in the past. Today the ethic of individualism does not downgrade education; rather, it encourages an instrumental attitude toward it, stressing individual mobility and economic return (9). The tremendous enlargement of the environment to be understood, the culture to be transmitted, and the constantly accelerating rate of change--all point to the importance of education.

These numerous factors have exercised a corresponding impact upon the public school secondary curriculum. A study of the trends in development of the high school offering reveals that numerous schools have increased the number of courses offered by as much as 475% over the past fifty years. A large percentage of this change has been effected during the past fifteen years. Courses have been synthesized into the curriculum to meet the criteria of being needed by, and of being of interest to the student, and of contributing to the ability of the individual to better prepare himself for life in a democratic society.

As indicated by Sidney Sulkin (65),

> Never have the schools appeared in such a ferment of self examination and change. Now, after so many years, what have they actually accomplished? What is the nature of the transformation that seems to be taking hold in the secondary schools? How do the colleges respond? What are the effects on the students?

It is Sulkin's last question that leads us to the purpose of and the need for this study. What are the effects of the so-called "reform movement" of the secondary schools upon the student?

Statement of the Problem

When the average American student approaches the ninth grade, he finds that numerous decisions must be made. One of the primary questions that must be considered concerns his attending an institution of higher learning after the completion of his high school education.

If he should decide that he will attend a college or university, he may find that his choice of high school curriculum content is severely limited. The "college preparatory curriculum" will prescribe a large portion of the high school courses that he will be advised to enter. It may be implied that, if the suggested courses are successfully completed, his ability to perform acceptable college work is enhanced, and that he will be better prepared for college. Thus, he may find himself enrolled in algebra when he may see a greater value and have a greater interest in consumer mathematics. He may be enrolled in a course in physics when he lives on a farm and would prefer to spend this time studying vocational agriculture. Such a situation may lead to a loss of interest, to underachievement, and to the possibility of dropping out of school.

The specific problem of this study will be to compare the college success of students with varying high school content backgrounds. Students with varying degrees of high school "college preparatory" courses will be studied, and the data will be analyzed for significance of this preparatory difference.

The data will be analyzed across colleges of the University in an attempt to determine whether the previous high school training may have different effects, depending upon the student's major field of study.

Need for the Study

The curriculum of the high school and even of the early years of college may properly be viewed as exploratory in much of its content and purpose. If evidence can be secured that the high school curriculum content does not significantly effect college success, then specialization can be postponed until the later adolescent years. At this time, the student should be more mature and, therefore, should be more able to select a satisfying profession or occupation.

If the degree of relationship between certain types of high school training and college success can be established, then counselors and others in responsible positions should have a guideline for advising students concerning the selection of their high school content.

Should the study indicate that high school content is not significant to college success, then the criteria of individual needs and interests can be allowed more weight in determining the selection of high school content. This should lead to increased efficiency of learning, a greater appreciation of our system of public education, and better mental health and personal adjustment of high school students.

The problem to be studied is inextricable from the concepts of "transfer of learning," which must, of necessity, be considered as one of the more important problems of education.

The many changes that have occurred in the secondary schools during the past decade, including the various implications of the sputnik age, the following surge of emphasis on mathematics, the sciences, and the foreign languages, plus the increased activity in the field of vocational education provided by the Vocational Education Act of 1963, would point toward a need for reassessment of the contribution, relative to success in higher education made by various types of high school training.

Professor Jerome Bruner (10) refers to education as both a process and a product. Since the end product of education is vested in the individual, the final judgement of the effectiveness of the educational process must be evaluated in terms of the individual's behavior. The effect of different experiences impinging upon the student as he progresses through his education must, therefore, be evaluated in light of how well it will prepare him to continue the journey down the educational pathway.

Thus, it seems appropriate that through the natural evolution of public education, the commission of one level to prepare the students for the next has been a significant factor in determining curriculum content. The recently-established Head Start Program should prepare the child to enter the elementary school. The elementary schools prepare the student for the junior high school. The junior high school prepares the student to enter high school. The high school prepares the student to enter college or the labor market.

The inter-relatedness of these various levels of education continually presents problems in sequence, scope, depth, and articulation from the pre-first grade level through the graduate school. However, the most severe effect seems to occur in determining the high school content. It is at this point that education would tend to acquire the dichotomous role of preparing the student for college or preparing him for a vocation.

It is also at this point that the student must make a very important decision concerning his educational and vocational future. Shall he enroll in the college preparatory, or one of the various non-college preparatory curricula? Even in the smaller secondary schools of from 100 to 400 pupils, one will find as many as two, and frequently three, different curricular programs, each leading to graduation with a diploma, such as the college preparatory curriculum, the general curriculum, and the business or commercial curriculum. In the secondary schools of larger size, there may be as many as six or seven "curricula," each with its array of new subject matter courses of a special nature for the benefit of students in that particular program (30).

Acknowledgment should be given that these are not completely different curricula. There remains a commonality of content due to the quasi-legal effects of State and National accrediting agencies. An analysis of the standards for graduation from secondary schools in four different sections of the nation shows that in general, three or four units of English are required, two or three units of social studies, one or two units of science, and some health and physical education. The similarity of minimum requirements for graduation exists in general for all types of separate and specialized programs of study (30). These basic requirements comprise from forty to sixty percent of the usual curriculum.

The student's choice at this point is further complicated by internal conflicts. Ginzberg (51) comments that the period during which an individual obtains his basic education is the same period during which he is preparing for the world of work. The period may be long or short, but there is an inevitable and implicit competition between the two objectives. Miller and Form (50) place the initial work period, consisting of part time jobs and exploration, between the ages of fourteen and twenty years. This is in agreement with Bueahler's exploration period, which is located in the same age span, and which emphasizes the importance of part time jobs, exploration and the development of self-understanding. Super's (67) tentative exploration stage covers the age span of fifteen through seventeen years and indicates that the individual is considering his needs, interests, capacities, values, and opportunities toward the world of work. However, considerations for reality are given more weight as the student matures. The vocational theory of Hoppock (41) and Havighurst's (35) developmental task theory are congruent with these findings.

Non-vocational developmentalists also acknowledge the stress experienced by the adolescent during this period. A prominent psychiatrist referred to the adolescent as being in the "not quite stage"--not quite an adult, not quite a child, and not quite sure of himself Lowrey (48). And yet, the long-term goals chosen at this time will influence the course of the indivudual's behavior for the remainder of his life span. In the words of Eric Erickson (20),

> The central problem of the period is the establishment of a sense of identity. The indentity the adolescent seeks to clarify is who he is, what his role in society is to be. Is he a child or is he an adult? Does he have it in him to be some day a husband and father? What is he to be as a worker and earner of money?

Of the many variables influencing the student at the time of choice, his current interests may be one of the more predominant. This would seem to be to his advantage since the criterion of interest is found to be in accord with the accepted knowledge of the psychology of learning. This criterion has been most persistently and thoroughly embraced by those who hold intelligent self-direction to be a major aim of education.

The capacity of self-direction is best developed, according to this view, by engaging in activities of concern to the individual. As the student seeks goals to which he feels committed, he learns to think for himself, to weigh and use knowledge. and to be self-dependent. In pursuing his interests, the need for knowledge, skills, and values arises. To some extent in the past, as the phrase "motivating the pupils" suggests, teachers were expected to find ways of changing unique motivational propensities so that every child would want to learn. In the future, perhaps, teachers may be expected to adapt teaching procedures and curriculum organization to the particular motivational patterns of the children in their classes (42). Regardless of the approach, research has indicated (25), (59), (31) that when an individual takes an active role in a learning situation, he tends to acquire the response to be learned more rapidly, and this response tends to be more stably formed than when he remains passive. Stated in different terms, Allport (6) maintains that there is a deeper level of participation which may be called "ego-involvement."

> To one child the activity is important, to the other it is not. We are obviously speaking now of interest. . . We have encountered various principles that claim to be "the most important" law of learning; but the case for interest is strongest of all. Interest is participation with the deepest levels of motivation.

The National Manpower Council (17) also gave credence to the criterion of interest in its statement,

> The important role of motivational factors has already been indicated. It is known that high scholastic aptitude cannot lead to college success and outstanding performance in later professional work unless the individual wants to succeed.

In view of this support, it would seem that curriculum selections based primarily on this criterion would be sound. However, most educators and psychologists would at the same time agree with Oliver (57) that the "interest doctrine" does not imply that all interest of all pupils are desirable, nor that the program should be built exclusively on those interests. They must be appraised to see whether they are in line with or will lead to the betterment of the individual. In other words, the identification of interests of a student body will strongly suggest areas which should be included in the curriculum.

Thus educators seem doomed to follow a circular path which eventually returns to the question, "What should be included in a curriculum for college preparation?"

Traditionally, the "academic subjects" have enjoyed a favored position in high school programs. The "non-academic subjects," on the other hand, have enjoyed a less favorable status. The non-academic subjects have tended to be omitted as requirements of high schools. A postulate could be employed that the academic subjects actually prepare a student for college to a higher degree than do the non-academic subjects. The consensus of experts in this matter is extremely variable. In one study it was found that even in tasks requiring verbal and mathematical material, the improvement from a year's study of foreign language and mathematics in high school was not much greater than the improvement from a year's study of typewriting and sewing (68).

Chapman and Counts (14) seem to favor the idea that the languages, mathematics, and exact sciences are of maximum value for developing ability to think because of the ease and clearness with which errors in thinking are brought to light. On the other hand, it may be argued that the very fact that geometry reveals so easily and clearly the errors of thinking may mean that it fails to give experience in evaluating the processes of thought in dealing with problems concerned with civic, family, social, economic, ethical, and recreational experiences, in which final and objective standards of right and wrong are not so numerous or obvious.

More recent research would indicate that the colleges were influenced by these discoveries to a greater extent than were the high school Attention is called, first, to the evidence that the specific requirements for college entrance is showing a steady decline. Requirements in terms of "units" or "credits" have become considerably more flexible. An increasing number of colleges either no longer prescribe a set pattern of courses or are willing to consider exceptions to the required list (52). This trend is exemplified by the Michigan Secondary School-College Agreement as follows (61).

> The college agrees to disregard the pattern of subjects pursued in considering for admission the graduates of selected accredited high schools, provided they are recommended by the school from among the more able students in the graduating class. This agreement does not imply that students must be admitted to certain college courses or curricula for which they cannot give evidence of adequate preparation.

This indicates that the studies of Thorndike, Gates, and others, showing that no subjects have special merit as instruments of college preparation, are being more and more accepted by the colleges as determinants of admission policy. Facts gathered by Harriger (32) showed the colleges to be calling for evidence of the applicant's general level of scholarship, character, and academic promise. The high schools, on the other hand, in their college preparatory curriculums tend to require four units of English, three or four of social studies, from two to four units of sciences, from two to four units of mathematics, and one or two units of foreign language. The comparison of these data with the facts of college entrance requirements seems to stamp the high schools as unnecessarily rigid, as adhering to tradition when new viewpoints are coming into control. The contrast is especially marked in the case of mathematics and science, in which 45 percent of the high schools require three or four units. This is an amount required by only two percent of the colleges. Criticism is just concerning the antiquity of the studies by Thorndike and Gates. However, as indicated by McDonald (36), transfer in learning in education is hardly advanced beyond Thorndike.

More recently, the interest in cognitive activity may imply that preparation is not a matter of transfer of learning. Bruner (11) indicates that instruction should be prescriptive in the sense of setting forth rules concerning the most effective way of achieving knowledge or skill. The primary emphasis is upon the development of cognitive structures, which can be defined as learned methods of information transformation. Through the use of his ability to think cognitively, the individual will be able to cope with new problems as they arise. Concerning what should be included in the curriculum, Bruner (11) states:

> We might ask as a criterion for any subject taught in primary school whether, when fully developed, it is worth an adult's knowing, and whether having known it as a child makes a person a better adult. If the answer to both questions is negative or ambiguous, then the material is cluttering the curriculum. If the hypothesis with which this section was introduced is true, that any subject can be taught to any child in some honest form, then it should follow that the curriculum ought to be built around the great issues, principles and values that a society deems worthy of the continual concern of its members.

Specific recommendations concerning the content of secondary curriculum have not been included in Bruner's coverage to date.

In conclusion, indications would lead one to believe that educators are uncertain as to what specific courses will best prepare the secondary student for a particular college major.

In view of the many conflicting factors which are operating during the period of time when the student must make his first choice concerning higher education, it is understandable that there will be numerous erroneous decisions. The student at the ninth or tenth grade level may elect the non-college preparatory curricula for one of various reasons. He may at that time be more interested in a particular aspect of vocational training, or he simply may not realize the importance of his future education. However, a substantial percentage of these same students may, by the time of high school graduation, have a desire to continue their education. Has the incorrect choice of high school curricula seriously impaired the probability of success in college; or will the basic subjects required for graduation from high school be sufficient to enable him to successful in college? Are there particular major areas of study where his probability of success will be enhanced?

These are the questions to which this study is directed.

CHAPTER II

REVIEW OF SELECTED LITERATURE

Introduction

Studies dealing with college achievement vary widely in method, situations, and conclusions. A review of the literature concerning this topic reveals the following trends: (1) The pattern of courses completed in high school as related to college achievement was of more interest from the period 1920 through 1940; (2) the bulk of the investigations then turned from determining the effect of this pattern to the task of predicting college achievement.

The more important predictor variables used have been high school grade point average, rank in high school graduating class, achievement and college entrance tests, intelligence tests, plus various measures of non-intellective ability including personality, and interest examination, socio-economic factors, and temperament surveys.

A comprehensive review and interpretation of investigations of factors related to scholastic success in colleges of Arts and Sciences and Teachers Colleges by Garrett (24) reveals that only eleven of the 194 studies surveyed were directly concerned with the pattern of high school subjects taken by the student. Fishman (23) reviewed 580 college admission selection studies in 1960 and does not specifically mention the pattern of courses undertaken by the student while in high school.

The design of most studies appears to be prompted by either an atomistic or a monistic philosophy: the atomistic group relates specific high school courses to specific college courses, or specific high school courses to college grade point average; while the monist attempts to discover the relationship between the entire preparatory background and the comprehensive criterion of college success. Studies of the second type are generally analysed in a manner to reveal the contribution of each element to the total. This survey of literature has been limited to a number of representative studies of both types in the broad area of college achievement and success.

Literature Summaries of College Achievement

Perhaps the most ambitious study in this field was made under the auspices of the Progressive Education Association, by Chamberlin (13) and others, entitled Did They Succeed in College? This was part of the Eight-Year Study in which nearly three thousand students from thirty high schools, both progressive and conservative, were traced through both high school and college. A comparison was drawn between those students who had deviated from the traditional curriculum for college bound-students and those who had continued to study a required number of academic courses. The students were admitted to all types of colleges and universities. The final summary included these statements by Chamberlin.

> These students--especially the ones having the most deviate courses--have done better in college than conventionally trained students. It has long been thought that a conventional college preparatory sequence was ill-suited to a majority of non-college students. The data from this study demonstrated that it is not necessarily best-suited for all

> those who do go on to college.
>
> It is quite obvious from these data that the Thirty Schools graduates, as a group, have done a somewhat better job than the comparison group whether success is judged by college standards, by the students' contemporaries, or by the individual students.

A University of Wyoming study by Byrns and Henmon (12) was particularly interested in the effect of foreign languages on college achievement. Other subjects were also included in the analysis. The sample was from the 1929 and 1930 entering classes and consisted of 687 seniors who had completed a minimum of seven semesters of college. Correlations were computed between college grade point average and the five traditional college preparatory areas of foreign language, science, mathematics, English, and social studies. Correlations found were all under . 36, with the exception of English which was . 59. The effect of intelligence was then held constant by use of an Ohio State Psychological Test, and correlations were run between foreign language, math, and the college grade point. Under these conditions, the highest correlation found was . 14, which was again for English. Nelson observed (12),

> It has been pointed out frequently, however, that the facts would indicate that language study in the secondary school is not the cause but the result. That is, students are not generally excellent because they take language, but they take language because they are excellent. Those who choose to take a foreign language when there is no compulsion are more intelligent than those who choose other subjects. The pragmatic sanction may justify the belief that foreign lanquages and mathematics are valuable instruments of instruction, but the evidence does not indicate that they are sacrosanct. They have probably been valued out of proportion to their significance for success in college. Their prominence both in high school curriculum and in college entrance requirements must be justified on some grounds other than mental training, for the facts seem to show that these subjects do not develop a student's capacity for successful college work.

Seigle (62) conducted a study at Washburn Municipal University to find some of the factors that were predictive of success in college mathematics at Washburn. He found that the number of units of high school mathematics taken by the student seemed to play a very small part in his success in other mathematics courses after his first course in college mathematics.

Two hundred seventeen student records at the University of Colorado were studied by Gebhardt (26) in an effort to determine the relationship between ability to do college work and specific subjects taken in high school. The following quotation summarizes the results:

> There is no significant evidence in this investigation to show that one subject or group of subjects is of greater value in itself than any other, as an aid to successful college work. . . . . The evidence tends to show that two people of equal ability, studying different subjects in high school, may do college work of equal grade.

Kennedy (43) completed a study in 1963 in which he explored the differences in academic achievement in an undergraduate college of business of students who had a varied background in high school. In his conclusions, he rejects the idea that any one pattern of high school subjects is to be preferred over another.

Working with a random sample of records from 200 students who had completed a minimum of three semesters at the Iowa State Teachers College, Nelson (56) made two types of comparisons: first, he compared the scholarship average of those presenting a certain minimum amount of entrance credit in a given field with the scholarship average of those who presented a larger amount; and second, he determined the correlation between the amount of entrance credit presented in a given field and scholarship for the first year of college work. With the exception of foreign languages there was no subject matter field in which those who had presented the larger amount of credit excelled over those who had presented the smaller amount. The highest correlation found was .39 for foreign language, and it is noted that several negative correlations appeared. Nelson concluded, "It does appear, however, that there seems to be little justification for requiring any specific amount of work in any subject."

Naibert (55) conducted a study to locate factors relating to success in a first course in college chemistry, and he found that in certain situations, the number of semesters of high school chemistry was significant at the five per cent level. However, he found that the most important single predictor to be the average of grades attained in all high school math courses.

In a study concerning the transfer of training from high school subjects to intelligence, Wesman (72) used five groups of high school sophomores and juniors. Each group differed from the other by one of the following courses: mathematics, history, science, or language. Gains were measured and correlated to intelligence quotients at the end of the year. Wesman made two statements concerning the study: (1) The course pattern revealed no superiority of any one school subject over any of the others studied. (2) In general, the study fails to reveal superior transfer to intelligence for any one of the achievement areas measured, and indicates the desirability of direct training in mental processes rather than dependence on transfer from other school subjects.

An investigation was made by Bolenbaugh and Proctor (7) at Stanford University in an effort to find out whether those who entered with an academic pattern of high school work achieved higher standing in college subjects than those who entered with a vocational pattern. The entering classes of 1921 and 1922, consisting of 716 students, were followed through their entire college career. All were administered the Thorndike Intelligence Examination upon admission to the university. When the Thorndike score was correlated with high school scholarship, the results indicated that the boys who carried from 15 to 50 percent of vocational work in their high school programs did better work, according to intelligence, than did the boys whose courses were strictly academic. In a correlation of high school scholarship with college achievement, the vocational group showed a correlation coefficient of .49, while the correlation for the other group with the academic pattern was only .28. The following conclusions were reached: (p. 92)

> (1) Not enough difference exists between the achievement of the academic-pattern group and the vocational-pattern group of the Stanford men, whose records were included in this investigation, to justify any discrimination against an applicant for college admission because he took from 15 to 50 percent of his preparatory subjects in the vocational group of high school subjects. (2) There are some indications that the vocational type of student tends to be more consistent in scholarship, since his high school record correlates more highly with his college record than is the case with the academic-pattern student. (3) Colleges can well afford to give high schools more freedom in the matter of courses taken by prospective students.

Brammell (8) reports conclusions similar to those of Proctor and Bolenbaugh. The average freshman grade of 163 students entering the University of Washington in 1925 with five or more year credits in non-academic subjects was 2.08 as compared to 2.22 for 353 students who entered at the same time with not more than one year credit in non-academic subjects. An even smaller difference was found for the class entering in 1928. The four year college average for the two groups entering in 1925 was found to be identical to the second decimal place.

Williams and Lafferty (73) sought to determine whether those students in freshman chemistry at East Texas State Teachers College who had taken a course in high school chemistry enjoyed any advantage over those who had no previous course in chemistry. Groups used for this two-year study were students classified as freshmen at one time during the years 1948 to 1950. The population was 171 students, about equally divided between those with a course in high school chemistry and those without. The study indicated that those students with high school chemistry had a small advantage over those who had not. Had they considered the relative academic standings of their two groups, they might have found an even smaller advantage of high school chemistry to students taking freshman college chemistry.

An investigation by Douglass (18) conducted in 1931 at the University of Oregon involved the examination of 1,196 records. Correlations were run between college G.P.A. and the following factors: high school G.P.A., high school science, high school English, high school foreign languages, high school mathematics, and a composite of high school vocational subjects. Correlations ranged from .35 between college G.P.A. and high school vocational subjects; to .56 between high school G.P.A. and college G.P.A. Douglass noted that the absence of a negative correlation between the number of high school credits in vocational subjects and college grade point average deserved closer analysis. Of the students presenting an excess of four units of vocational subjects for admission, very few were distinctly superior or inferior students. He concluded that, at best, the pattern of high school units as a means of selecting good college risks is but another way of measuring intelligence and industry; and that the number of units taken in any one subject matter field in high school does not furnish a satisfactory basis for predicting college success.

Hoff (38) studied the grades achieved by 340 freshman students in chemistry at State Teachers College, La Crosse, Wisconsin. Of these, 92 students had not studied chemistry in high school and 254 had. He found that the high school chemistry group showed a slightly superior scholastic ability over the group with no high school chemistry. When abilities of the two groups were equalized, the students who had studied chemistry in high school maintained a grade point factor of only . 83 per cent. The author concluded that, because of this extremely low grade point factor advantage, the study of chemistry in high school had no significant effect on the grades achieved in college chemistry.

A study of students who graduated from Philadelphia High School and who attended Temple University was conducted by Gladfelter (28). The following correlations were found:

Four-year H. S. average with freshman G. P. A.	. 68
Four-year H. S. average in English with college English	. 59
H. S. modern languages with freshman modern languages	. 48
First-year H.S. algebra and geometry with college math	. 36
Two years of H. S. algebra geometry with college math	. 50
H. S. trigonometry with college trigonometry	. 55
H. S. social science with college european history	. 66
H. S. science with college zoology	. 38
H. S. science with college biology	. 48
H. S. science with college chemistry	. 65

The correlations from this study are consistently higher than those found in most investigations of this type. The common high school from which all students graduated is one possible explanation of this evident increase in the relationships.

Clark (16) at the University of Southern California compared the marks of two groups of freshmen entering that institution in 1923. One group entered with the twelve or more "standard" preparatory high school units, while the other fell short of the required number of preparatory units. The former group passed 93. 3 percent of the college work which they attempted. The 166 students who had not met the entrance requirements passed 89. 7 percent of their college work yielding a bi-serial correlation coefficient of . 09. Clark concluded that obviously this small superiority on the part of students who had completed certain specified preparatory requirements was practically negligible for purposes of prediction.

A more recent study conducted by Giusti (27) used the high school records of 397 men and women students who were admitted to the Pennsylvania State University College of Education on a regular basis in September of 1960, and who were graduated from an accredited high school not more than three months before that date. The high school records of these students were studied with respect to six variables: English, mathematics, history, science, foreign languages, and the general average in high school including all subjects. The grade point averages of each of these variables were computed for each case from the high school records. The college grade point average for the freshman year was used as the criterion of college success. Product-moment correlations were calculated to ascertain the strength of linear relationships among the various pairs of variables. The highest correlation found between the six variables and the college grade point average was

.47. This correlation was between the over-all high school average and the college grade point average.

Lins, Abell, and Hutchins (46) report on the relative usefulness in predicting academic success from college aptitude tests and other selected variables. This study included 1,892 males and 1,932 females who entered the University of Wisconsin in the fall of 1962. Correlation coefficients were computed between first semester, second semester, and first year G. P. A.'s, and selected variables for men and women. Thetwo variables of interest to this study were the ACT composite score and the number of high school academic units. The highest correlation found between the ACT composite score and G. P. A. was in the first semester analysis of performance for women, where the correlation was found to .53, accounting for approximately 25 percent of the total variance. It was noted that this relationship weakened from the first to the second semester of college. The strongest relationship found between the college G. P. A. and the number of academic units completed in high school was .28. This correlation also decreased markedly for the second semester of college. The following statements and conclusions were made.

> People interested in academic matters have long implied a relationship between rigor in terms of academics and quality of preparation. In considering the means on high school academic units presented for college entrance, the differences are not great, but the direction of the differences is opposite to that which one normally would expect.
>
> The results of this study do not support the hypothesis that the first semester G. P. A. at the university is positively related to the rigor of the academic program pursued in high school, since university under-achievers have the higher average number of academic courses taken in high school.

Summary

The review of the literature fails to provide sufficient evidence that general college success or failure is a direct result of the pattern of courses studied while in high school.

The review does point to the fact that the major component of predicting academic success is of an intellective nature. Goodstein (29) noted in 1963 that aptitude and achievement accounted for approximately thirty-five percent of the total variance of the criterion of college achievement as represented by college grade point average. He further stated that, since the total variance was not accounted for, one must assume that at least one other factor and probably several factors were involved. Goodstein groups these into "non-intellective" factors or syndromes including such variables as personality and interest.

Fishman (23) comments that the most obvious intellective predictor is the high school record, usually expressed as a total average grade or rank in class. For 263 studies in which it was employed, this measure correlated approximately .50 with the freshman college grade point average.

The obvious lack of interest in using the high school subject matter pattern as a predictive criterion and the lack of recent literature concerning this topic would lead to the acceptance of Vaughn's statement (70).

> To date we have found no study that supports the thesis that so called "Academic" subjects constitutes a "significantly" better preparation for entrance to college than the non-academic subjects.

CHAPTER III

DESIGN AND METHODOLOGY

Introduction

The issue under investigation within this study concerns the relationship between the pattern of courses undertaken by the student while in high school and his corresponding degree of academic performance as a college student.

The objective of this chapter is to present: (1) a description of the sample; (2) operational definitions to be employed; (3) the basic plan for this dissertation; (4) instruments used in the study; (5) a description of the methodology applied; (6) the hypotheses to be tested; and (7) a description of the statistical treatment of the data.

Description of the Sample

The sample was selected from the entering freshman class of New Mexico State University of the academic year 1962-63. They were chosen because (1) this university was interested in the results from this type of investigation, and therefore willing to furnish the data; (2) the proximity of the university to the principle investigator; (3) the Research Coordinating Unit of the New Mexico State Department of Vocational Education desired information of the type to be generated by this study, and thereby agreed to fund the project.

The sample was limited to those students who entered the university as regular freshmen for the first semester of the school year 1962-63 and whose high school transcript and ACT test scores were available from the university. Further delimitation was employed to exclude those students with a foreign educational background, since there was no common basis for evaluating their records. Students enrolled for less than nine hours of course work were not included in the sample. The final treatment groups came from 906 students meeting the above criteria. From this population came the 454 students who comprised the final sample. The selection method employed is discussed under the heading of methodology, page 35.

This resulted in 228 students who had completed a "college preparatory" high school curriculum, (hereafter called Group A) and 226 students who had completed a "non-college preparatory" sequence (hereafter called Group B).

Group A was represented by 170 graduates from 31 New Mexico high schools, and 58 graduates from 24 other states. Group B was comprised of 176 graduates from 53 New Mexico high schools and 50 graduates from 19 other states. This information is summarized in Table I.

The total sample was sub-divided into male and female sub-classifications. The male sub-division for Group A was comprised of 127 students representing 27 New Mexico high schools, and 54 students from 24 other states. Group B contained 93 students from 41 New Mexico high schools and 45 graduates representing 17 other states. Table II illustrates these classifications.

The resulting female sub-sample is depicted in Table III.

The academic performance of the total sample and the sub-samples, as measured by the college grade point average, was examined for eight consecutive semesters. The reader should note that the composition of the groups is dynamic and will change as dropouts and changes in college majors occur within the various classifications.

TABLE I

RESIDENT STATUS, N'S, STATES AND HIGH SCHOOLS REPRESENTED FOR MALES AND FEMALES

	GROUP A	GROUP B
RESIDENT	170	176
NON RESIDENT	58	50
TOTAL N	228	226
RESIDENT HIGH SCHOOLS REPRESENTED	31	53
OTHER STATES REPRESENTED	24	19

Operational Definitions

Within the structure of this dissertation the following terms are used as defined.

1. Group A: Those students who included a MINIMUM of 73 percent of their high school curriculum in the college preparatory courses as defined.

2. Group B: Those students who included a MAXIMUM of 59 percent of their high school curriculum in the college preparatory courses as defined.

TABLE II

RESIDENT STATUS, N'S, STATES AND HIGH SCHOOLS REPRESENTED FOR MALES ONLY

	GROUP A	GROUP B
RESIDENT	127	93
NON RESIDENT	54	45
TOTAL N	181	138
RESIDENT HIGH SCHOOLS REPRESENTED	27	41
OTHER STATES REPRESENTED	24	17

TABLE III

RESIDENT STATUS, N'S, STATES AND HIGH SCHOOLS REPRESENTED FOR FEMALES ONLY

	GROUP A	GROUP B
RESIDENT	43	83
NON RESIDENT	4	5
TOTAL N	47	88
RESIDENT HIGH SCHOOLS REPRESENTED	28	34
OTHER STATES REPRESENTED	4	5

3. College Preparatory Courses: The courses which are usually required by the high school in the traditional areas of English, mathematics, social studies, science, and foreign languages; plus further courses in the same or closely related areas, (Appendix A, p.

4. Non-College Preparatory Courses: Those courses which are usually elective in the high school curriculum, including the pre-vocational and vocational courses, the domestic arts, fine arts, business education, health and physical education, and those courses which are not defined as college preparatory, (Appendix A, p.

5. College or Academic Success or Achievement: The criteria for this measure will be the college grade point average only. It is considered as a continum, with the degree of success increasing as the grade point average increases.

6. Concomitant Variable: The "X" variable entered into the regression equation in the analysis of covariance.

7. Significant: The .05 or smaller level of confidence of probability.

8. Abbreviations:

   a. G P A - Grade Point Average
   b. H S - High School
   c. A C T - The American College Test
   d. AG - The college of Agriculture and Home Economics
   e. A & S - The college of Arts and Sciences
   f. Engr. - The college of Engineering
   g. T. Ed. - The college of Teacher Education
   h. BA - The college of Business Education and Economics

Basic Plan of the Study

Four hundred fifty-four students of New Mexico State University were identified as the sample for this study. These students were then dichotomized into Group A, those students who had completed a traditional college preparatory high school sequence, and Group B who had not. The total sample was also divided into male-female subgroupings for further study.

The basic plan was to compare the two groups in an effort to determine the academic performance resulting from the two different curriculum treatments. Analyses were conducted on the total group, and on separate male-female sub-divisions. Academic achievement was investigated among the different colleges of the university in an effort to discover differences which could be attributed to the particular treatments.

Essentially, the design of the study is neither experimental nor quasi-experimental but can be more properly considered as descriptive and ex post facto. Kerlinger (44) defines this type of research as:

> . . . That research in which the independent variable or variables have already occurred and in which the researcher starts with the observation of a dependent variable or variables. He then studies the independent variables in retrospect for their possible relations to, and effects on, the dependent variable or variables.

In his study of The Psychology of Careers, Super (67) comments that intelligence has been defined in a variety of ways but may appropriately be thought of as the ability to learn. In relating the role of intelligence to vocational development and aspirations, he states:

> Intelligence is related to the occupational level aspired to: that is, the brighter the individual, the more likely he is to aspire to higher level occupations, and the duller

> he is, the more likely he is to be interested in lower level occupations. Ability seems to find outlets which are appropriate, occupations in which it can be used.

The review of the literature as made by this writer supported Super's hypothesis without exception (8), (17), (70). As previously quoted in the literature summary, Byrns and Henmon (12) indicated that the "brighter students tend to include the traditional academic subjects in their high school curriculum to a greater extent than do the less intelligent". This conclusion was strongly supported by a recent study conducted by Paul Lohnes (47). The population sampled was 8,500 tenth grade students in the New Hampshire public schools. The sample of 850 students was broken into two curriculum groups, all college preparatory students, and all who elected curricula which did not prepare for college. Test scores on the School and College Ability Tests were investigated for a possible relationship to the type of curricula elected by the students of each group. Using national norms for tenth grade students, it was found that the group electing the college preparatory sequence scored at the 84th percentile in the verbal subsection of the battery, while the non-college preparatory group scored at the 51st percentile, representing approximately one standard deviation difference between the groups. The quantitative scores revealed a percentile rank of seventy-nine for the college preparatory group, as compared to forty-nine for the non-college preparatory group. This was slightly greater than three-fourths of a standard deviation unit between groups. Various other measures of ability were administered to this sample. Lohnes concluded that the group aspiring to the college preparatory curricula was decidedly superior in performance on all of the tests.

In view of this information, a preliminary examination of the ACT composite scores was conducted for the two groups. The mean score on this measure indicated that Group A ranked at the sixty-first percentile, while Group B scored at the nineteenth percentile rank. Using national norms for college-bound high school seniors, the difference in mean scores for the two groups represented one and one-fourth standard deviation units, in favor of the college preparatory group.

With the limitations of *ex post facto* research in mind, need for an instrument to control this source of variation resulted in the selection of an analysis of covariance, using the ACT composite score as the concomitant variable. Concerning the use of covariance, Ferguson (22) states:

> Situations arise, however, where one or more variables are uncontrolled because of practical limitations associated with the conduct of the experiment. A statistical, rather than an experimental, method may be used to "control" or "adjust" for the effects of one or more uncontrolled variables, and permit, thereby, a valid evaluation of the outcome of the experiment. The analysis of covariance is such a method.

Instrument Used

AMERICAN COLLEGE TEST BATTERY. The ACT battery is described by the publishers as a battery

> "designed to measure as precisely as possible the ability of a student to perform those intellectual tasks he is likely to face in his college studies. In the tests emphasis is placed on generalized skills and abilities such as organization, criticism, judgement, and evaluation rather than on a knowledge of the factual organization and content of classroom courses." (1)

For the purposes of this study the composite score was used. It is the mean of the four sub-test scores: English Usage, Social Studies, Reading, Mathematics Usage, and Natural Sciences Reading. The e-liability coefficients of the ACT battery range from .83 to .88 with a median of .85 (1).

ACT regards the classification of the battery as to whether it is measuring aptitude, achievement, or other factors as an academic question. Concerning content validity, they state that there is no substitute for the actual examination of the instrument. The predictive validity of the ACT composite score versus overall college grade point average was found to yield a median correlation of .49 (2).

Although the relationship of the ACT composite score to high school grades has not been thoroughly investigated, Hoyt (4) found an intercorrelation of .40 when the records of 1,065 students in a state college were examined. This accounted for only sixteen percent of the variability in those high school grades.

A study of the test-retest correlations for a two-year interval reported by Munday and Hoyt (53) indicated a coefficient of .84 for the ACT composite score.

> The figure reflects variations in test performance due to any unreliability of a given form, any differences in parallel forms, and the effects of two years of higher education. Under these conditions the test results were relatively stable.

Munday (4) reported a correlation of .77 between the ACT composite score and the Otis Intelligence Test. This coefficient compares favorably to intercorrelations found between various group intelligence tests.

The various tests of the ACT battery are describes as follows (3):

> English Usage Test - This test measures the student's education development in the use of the basic elements of correct and effective writing; punctuation, capitalization, diction, phraseology, and organization of ideas.
>
> The test consists of several written exercises containing a number of errors or inappropriate expressions. The

student's task is to identify the cases of improper English usage and to choose the most acceptable substitutes. Approximately 75 percent of the items are concerned with the appropriateness of words and phrases, paragraphing, work order, effectiveness of various constructions, diction, style, organization of ideas, and general facility with the language. The remaining items are concerned with formal correctness of punctuation, capitalization, and grammar. Since the test was constructed to parallel as closely as possible the tasks a student faces in actual writing situations it does not measure ability to state formal rules and principles of grammar.

Mathematics Usage Test - This test measures the student's educational development in the use of mathematical principles for solving quantitative problems and in the interpretation of graphs and charts.

The test is composed of two general kinds of problems; (a) quantitative reasoning based on practical situations and (b) formal exercises in geometry, first-year algebra, and advanced arithmetic. The reasoning problems are drawn from a variety of areas - industry, business and finance, home management, the social sciences, and the natural sciences - and cover such topics as proportions and percentages, costs and profit, interest, and interpretation of graphs and tables. Exercises include such problems as solving first-degree equations in one and two unknowns, implifying algebraic expressions, substituting in formulas, working with roots and powers, factoring quadratics, computing areas of polygons, applying the Pythagorean theorem, and understanding relationships of angles.

Social Studies Reading Test - This educational-development test measures the student's ability to read materials from the social studies with critical understanding and to do the various kinds of reasoning and problem solving characteristic of these fields. The test, which attempts to differentiate between students who have acquired a broad understanding of social principles and those who have not, consists of reading passages followed by related test questions. Also included are discrete factual questions based on prior knowledge.

Typical reading passages are concerned with topics and problems in the field of the social studies - political science, economics, sociology, geography, American and world history, psychology, and anthropology. The discussions center on important aspects, theories, and controversies within these fields and emphasize relevant concepts, terminology, and styles of writing. Test questions require a clear comprehension of the reading principles usually covered in high school social studies courses, and an ability to do critical thinking about the problems and issues presented.

The questions emphasize broad interpretations and call for the integration of a number of elements in the passage.

The general skills tested include (a) recognizing, and taking into account the author's biases and points of view, (b) evaluating evidence and distinguishing between fact and opinion, (c) grasping implied meanings and (d) recognizing false or specious logic.

Natural Sciences Reading Test - This educational-development test measures the student's ability to interpret and evaluate reading materials in the natural sciences. Like the social studies test, the Natural Sciences test is cast chiefly in the form of a reading test, although it also includes a number of discrete factual items. It is designed to draw heavily on the student's science background and his ability to comprehend the content of the reading passages. The reading passages and the questions accompanying them are designed to assess the student's understanding of the methods of science, the nature of experimentation, the processes by which scientists develop new understandings and insights, and the logical steps scientists follow in arriving at conclusions and generalizations.

Typical reading passages, for example, present summaries of the procedures and results of one or more simple experiments. The student, in responding to specific items, is required to demonstrate his understanding of the purposes of the experiments, the hypothesis tested by each, the logical relationships among them, and valid conclusions or generalizations that can be inferred from the series of experiments as a whole. Other passages present materials that are assumed to be unfamiliar to most high school students; the student's task is to demonstrate his mastery by applying the principles and generalizations developed or implied in the passage to new examples of more familiar material, by noting the limitations of the principles, by specifying the assumptions underlying them, and by synthesizing facts and observations presented independently in the text.

Composite - The composite score is the mean (average) of the four educational-development scores. It is viewed as an index of total educational development and has proved to be the best single predictor of freshman success in college.

Methodology

The review of the literature suggested that previous investigations of this same general type have dichotomized the curriculum and referred to the traditional areas of English, mathematics, social studies, natural sciences, and foreign languages as the college preparatory sequence. After due consultation with secondary school counselors and administrators, higher education curriculum consultants, and members of the State Department of Education, this dichotomy was arbitrarily made by the principle investigator. All courses not included in the college preparatory category, automatically by definition were included in the non-college preparatory category. The reader is referred to Appendix A (p. 95) for a more nearly complete listing of this dichotomy.

A complete record of the high school transcript and ACT scores for each of the 906 subjects was secured from the office of the college registrar. Each of these was examined and the amount of time spent by the student in the different courses was converted to standard Carnegie units.

Each transcript was then evaluated, and the results tallied as to the number of Carnegie units in the college preparatory area, and the number in the non-college preparatory area. This included four years of high school work from the ninth through the twelfth grade. The total units of high school credit divided into the number of college preparatory units provided a measure of the high school curriculum background for the student expressed as a percentage figure. All courses attended by the student were included.

The records were then arranged in rank order, according to the percentage of college preparatory content included in the student's high school curriculum. Divisions were made at the first and third quartiles according to acceptable standards for establishing groups from ordinal data. This resulted in the establishment of Group A as those students completing 73 percent or more of their high school work in the college preparatory area; and Group B as those students completing 59 percent or less of their high school curriculum in the college preparatory area. All students having the same percentage of college preparatory units as the student who was actually on the first and third quartile points were included in the sample. The number of subjects in the study was then established as 228 in Group A, and 226 in Group B.

A complete record of the college academic performance for each of the 454 subjects was then secured from the college registrar's office, and the following information was recorded for each semester of each student's tenure: (1) the number of semester hours attempted; (2) the number of grade points earned; and (3) the college of the university in which the student was enrolled.

This was in accordance with policy at New Mexico State University, where the unit is the semester hour, and grading is on a four point scale; with A equal to four points, B equal to three points, C equal to two points, D equal to one point, and F equal to zero points. No consideration to the plus and minus signs in grading is given on the student's official transcript.

The previously named items--plus a student identification number, the ACT standard scores, sex, and whether the student graduated from New Mexico State University during the eight semester period were then placed on I. B. M. cards.

Statement of Hypotheses

This study is concerned with the relationship between the pattern of courses undertaken by the student while in high school and his corresponding degree of academic success in the college setting.

More specifically, are the two types of high school programs related to successful performance in college, and how are performances in the programs related to acceptable academic work in the various colleges of the university.

The Hypotheses to be examined, and which will be tested at the end of each semester for eight consecutive semesters on the total group and on male-female subgroups, are as follows:

> Hypothesis I: There is no significant difference in the mean grade point average between Group A and Group B when the ACT composite score is treated as a concomitant variable in an analysis of covariance.
>
> Hypothesis II: There is no significant Group by College Interaction when the ACT composite score is treated as a concomitant variable in an analysis of covariance.
>
> Hypothesis III: There is no significant difference in the mean grade point average of students among the various colleges of the University when the ACT composite score is treated as a concomitant variable in an analysis of covariance.

Statistical Treatment of the Data

The statistical procedure employed is known as A Least-Squares Analysis of Data with un-equal sub-class numbers. The model provides for a fixed two-way classification with interaction and regression. For a complete study of this method, the reader is referred to Harvey (34).

Basically, the analysis of covariance is a combination of the analysis of variance and regression. This method forms the sums of squares and cross products matrix, inverts the matrix, obtains estimates of the parameters involved, calculates the reduction due to the mean, the reduction due to each dependent variable, computes the error sum of squares, variance estimates, and *F* values. The *F* test is valid for main effects and interaction.

This design and procedure selected yields the following paradigm.

TABLE IV

PARADIGM FOR AN ANALYSIS OF COVARIANCE STATISTICAL TREATMENT

	Colleges-Independent variables				
	AG.	A & S	Engr.	T. Ed.	BA
Independent Treatment Variables					
Group A					
Group B			Dependent Variable=College GPA		
Concomitant Variable "X"					

Should the F test reveal significant differences in the adjusted treatment means, Duncan's (19) new multiple-range test was employed to locate them. This method compares each treatment mean with every other treatment mean, and calls for a set of significant differences of increasing size, the size to depend upon the closeness of the means after ranking.

In addition to the basic analysis of covariance using the ACT composite score as the concomitant variable; several additional *a priori* analysis were conducted at selected points as aids to interpretation of the data. Included were the following:

1. A multi-variate analysis for each semester with high school background as the independent variable, college GPA as the dependent variable and each of the four ACT subscores as concomitant variables.

2. An analysis of variance for each semester on the following: each of the ACT subscores, the ACT composite score, the number of college semester hours attempted, and the college Grade Point Average.

3. The basic analyses and both supplementary analyses listed above were conducted on a cumulative basis each semester for the total sample.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Introduction

The purpose of this chapter is to determine if a significant difference existed in the mean grade point average between Group A and Group B, when the ability to perform college tasks as measured by the American College Test was statistically adjusted for in an analysis of covariance. The data was also analysed to determine whether significant differences in GPA occurred among the various colleges of the university, and to determine whether significant group by college interaction occurred.

Findings of this investigation are reported under three headings; first, an analysis of the total group, including males and females for eight consecutive semesters; second, an analysis of the males only for eight consecutive semesters; and third, an analysis of the females only for eight consecutive semesters.

To avoid repetition, the Hypotheses are stated at the beginning of each section only. The disposition of the hypotheses are summarized at the end of this chapter. A discussion of the findings, and conclusions is presented in Chapter V.

Testing of Hypotheses for the Total Group

Hypothesis I, Semester I: There is no significant difference in the mean grade point average between Group A and Group B when the ACT composite score is treated as a concomitant variable in an analysis of covariance.

From Table V, the obtained F value for groups is found to be 1. 42. The required value for significance was 3. 84. Results of this F test led to a conclusion that no significant difference existed between the groups and the null hypothesis was not rejected.

TABLE V

ANALYSIS OF COVARIANCE OF COLLEGE GPA
FOR MALES AND FEMALES
SEMESTER ONE

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.899	.899	1.420
Colleges	4	2.540	.635	.999
G X C	4	1.966	.492	.773
Regression	1	70.008	70.008	110.211
Within	443	281.416		
Total	453	424.615		

Hypothesis II, Semester I: There is no significant Group by College interaction when the ACT composite score is treated as a concomitant variable in an analysis of covariance.

The F value from Table V for Group by College interaction is .773. The required value for significance was 2. 37, therefore the null hypothesis was not rejected.

Hypothesis III, Semester I: There is no significant difference in the mean grade point average of students among the various colleges of the University when the ACT composite score is treated as a concomitant variable in an analysis of covariance.

In the absence of significant interaction, examination of the _F_ value of .999 for Colleges is found to be insignificant and the null hypothesis was not rejected. For an examination of the unadjusted and adjusted college means the reader is referred to Table VI.

TABLE VI

GROUP AND COLLEGE GRADE POINT MEANS
FOR MALES AND FEMALES
SEMESTERS ONE AND TWO

	SEMESTER ONE		SEMESTER TWO	
	UNADJUSTED MEANS	ADJUSTED MEANS	UNADJUSTED MEANS	ADJUSTED MEANS
GROUP A	2.20	1.89	2.34	2.08
GROUP B	1.44	1.77	1.64	1.92
AG	1.45	1.79	1.67	1.92
A & S	1.95	1.89	2.18	2.13
ENGR.	1.96	1.72	2.18	1.95
T. ED.	1.83	1.95	1.95	2.03
BA	1.61	1.80	1.63	2.02
COMMON MEAN	1.82		2.03	

Hypothesis I, Semester II: For one and 360 degrees of freedom, an _F_ value of 3.84 is required to be significant at the .05 level of probability. Table VII indicates an _F_ value of 1.56 for groups. On this basis the null hypothesis of no difference between groups is not rejected.

Hypothesis II, Semester II: The F value for Group by College Interaction was found to be .26. The F value required for significance is 2.37, therefore the null hypothesis of no significant interaction was not rejected.

Hypothesis III, Semester II: In the absence of significant Group by College interaction, an examination of the F value for colleges from Table VII is found to be 1.00. The required level for significance is 2.37. Results of this F test led to a conclusion that no significant differences existed between the college means and the null hypothesis was not rejected. Unadjusted and adjusted college means for Semester II are presented in Table VI.

TABLE VII

ANALYSIS OF COVARIANCE OF COLLEGE GPA FOR MALES AND FEMALES SEMESTER TWO

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	1.021	1.021	1.56
Colleges	4	2.574	.643	1.00
G X C	4	.663	.166	.26
Regression	1	48.279	48.279	75.44
Within	360	230.407	.640	
Total	370	331.783		

Hypothesis I, Semester III: From Table VIII, the obtained F value for groups is found to be .741. The required value for significance was 3.84. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of groups [illegible] and

B, and the null hypothesis was not rejected.

TABLE VIII

ANALYSIS OF COVARIANCE OF COLLEGE GPA FOR MALES AND FEMALES SEMESTER THREE

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.470	.470	.741
Colleges	4	3.722	.931	1.468
G X C	4	3.556	.889	1.401
Regression	1	38.095	38.095	60.082
Within	256	162.322	.635	
Total	266	220.013		

Hypothesis II, Semester III: The F value from Table VIII, for Group by College interaction is 1.40. The required value for significance was 2.37, therefore the null hypothesis was not rejected.

Hypothesis III, Semester III: In the absence of significant interaction, examination of the F value of 1.47 was found to be insignificant and the null hypothesis of no difference in college grade point means was not rejected. Unadjusted and adjusted college means are presented in Table IX.

Hypothesis I, Semester IV: From Table X, the obtained F value for groups is found to be .410. The required value for significance was 3.84. Results of this F test led to a conclusion that no significant differences existed between the mean grade point averages of groups A and B, and the null hypothesis was not rejected.

Hypothesis II, Semester IV: The F value from Table X, for Group by College interaction is . 484. The required value for significance was 2. 37, therefore, the null hypothesis was not rejected.

TABLE IX

GROUP AND COLLEGE GRADE POINT MEANS FOR MALES AND FEMALES SEMESTERS THREE AND FOUR

	SEMESTER THREE		SEMESTER FOUR	
	UNADJUSTED MEANS	ADJUSTED MEANS	UNADJUSTED MEANS	ADJUSTED MEANS
GROUP A	2. 23	2. 04	2. 41	2. 36
GROUP B	1. 94	2. 18	2. 26	2. 46
AG	1. 97	2. 08	2. 41	2. 49
A & S	2. 30	2. 28	2. 41	2. 37
ENGR.	2. 14	1. 99	2. 26	2. 26
T. ED.	1. 87	1. 99	2. 40	2. 47
BA	1. 83	2. 22	2. 31	2. 47
COMMON MEAN	2. 12		2. 36	

Hypothesis III, Semester IV: In the absence of significant interaction, examination of the F value of . 549 for colleges from Table X, is found to be insignificant. The null hypothesis of no difference in college grade point means was not rejected. Unadjusted and adjusted college means are presented in Table IX.

Hypothesis I , Semester V: From Table XI the obtained F value for groups is found to be . 32. The required value for significance was 3. 84. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

TABLE X

ANALYSIS OF COVARIANCE OF COLLEGE GPA
FOR MALES AND FEMALES
SEMESTER FOUR

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.253	.253	.410
Colleges	4	1.356	.339	.549
G X C	4	1.195	.299	.484
Regression	1	14.069	14.069	22.823
Within	210	129.455	.616	
Total	220	151.249		

TABLE XI

ANALYSIS OF COVARIANCE OF COLLEGE GPA
FOR MALES AND FEMALES
SEMESTER FIVE

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.212	.212	.324
Colleges	4	6.994	1.749	2.661
G X C	4	1.368	.342	.520
Regression	1	6.466	6.466	9.824
Within	160	105.371	.659	
Total	170	126.837		

Hypothesis II, Semester V: The F value from Table XI, for Group by College interaction is .52. The required value for significance was

2.37, therefore, the null hypothesis was not rejected.

Hypothesis III, Semester V: In the absence of significant interaction, examination of the F value from Table XI for colleges reveals a value of 2.66. The required value for significance was 2.37. The results of this F test led to a conclusion that significant differences did exist in grade point average among the various colleges of the University, and the null hypothesis of no difference was rejected. Unadjusted and adjusted college means are presented in Table XII.

TABLE XII

GROUP AND COLLEGE GRADE POINT MEANS
FOR MALES AND FEMALES
SEMESTERS FIVE AND SIX

	SEMESTER FIVE		SEMESTER SIX	
	UNADJUSTED MEANS	ADJUSTED MEANS	UNADJUSTED MEANS	ADJUSTED MEANS
GROUP A	2.51	2.45	2.61	2.60
GROUP B	2.24	2.35	2.40	2.53
AG	2.56	2.62	2.72	2.89
A & S	2.71	2.61	2.84	2.96
ENGR.	2.19	2.05	2.22	2.06
T. ED.	2.49	2.53	2.53	2.55
BA	2.02	2.18	2.22	2.34
COMMON MEAN	2.42		2.54	

In light of the significance indicated by the F test among the college means; Duncan's New Multiple Range Test was applied to locate where the differences existed. The results of this test are presented in Table XIII.

TABLE XIII

MULTIPLE RANGE TEST OF COLLEGE MEANS
FOR MALES AND FEMALES
SEMESTER FIVE

ADJUSTED MEANS FOR COLLEGES

Engr.	BA	T. Ed.	A & S	Ag.
2.05	2.18	2.53	2.61	2.62

NOTE: Any two means not underscored by the same line are significantly different.

Any two means underscored by the same line are not significantly different.

Hypothesis I, Semester VI: From Table XIV the obtained F value for groups is found to be .114. The required value for significance was 3.84. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B., and the null hypothesis was not rejected.

Hypothesis II, Semester VI: The F value from Table XIV for Group by College interaction is 1.301. The required value for significance was 2.37, therefore, the null hypothesis was not rejected.

Hypothesis III, Semester VI: In the absence of significant interaction, examination of the F value for colleges reveals a value of 5.480. This value is significant beyond the .01 level of significance. The results of this F test led to a conclusion that differences did exist in the adjusted college means, and the null hypothesis was rejected.

Unadjusted and adjusted college means are presented in Table XII, page 48.

TABLE XIV

ANALYSIS OF COVARIANCE OF COLLEGE GPA FOR MALES AND FEMALES SEMESTER SIX

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.061	.061	.114
Colleges	4	11.798	2.947	5.480
G X C	4	2.799	.700	1.301
Regression	1	6.246	6.246	11.611
Within	131	70.475	.538	
Total	141	91.201		

Due to the significant F value for colleges, Duncan's New Multiple Range Test was applied to locate the differences. Results of this test are presented in Table XV.

TABLE XV

MULTIPLE RANGE TEST OF COLLEGE MEANS FOR MALES AND FEMALES SEMESTER SIX

ADJUSTED MEANS FOR COLLEGES

Engr.	BA	T. Ed.	Ag.	A & S
2.06	2.34	2.55	2.89	2.96

NOTE: Any two means not underscored by the same line are significantly different.

Any two means underscored by the same line are not significantly different.

Hypothesis I, Semester VII: From Table XVI the obtained F value for groups is found to be .52. The required value for significance was 2.45. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

TABLE XVI

ANALYSIS OF COVARIANCE OF COLLEGE GPA
FOR MALES AND FEMALES
SEMESTER SEVEN

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.288	.288	.520
Colleges	4	5.510	1.377	2.473
G X C	4	1.202	.301	.541
Regression	1	8.402	8.402	15.086
Within	98	54.578	.557	
Total	108	70.685		

Hypothesis II, Semester VII: The F value from Table XVI for Group by College interaction is .54. The required value for significance was 2.45, therefore, the null hypothesis was not rejected.

Hypothesis III, Semester VII: In the absence of significant interaction, examination of the F value for colleges from Table XVI reveals a value of 2.47, which was significant at the .05 level. The results of this F test led to a conclusion that significant differences did exist in the grade point means among the various colleges of the University. Unadjusted and adjusted college means are presented in Table XIX, page 54.

Due to the significant F value for colleges, Duncan's New Multiple Range Test was again applied to the data to locate the differences. The results of this test are presented in Table XVII.

TABLE XVII

MULTIPLE RANGE TEST OF COLLEGE MEANS
FOR MALES AND FEMALES
SEMESTER SEVEN

ADJUSTED MEANS FOR COLLEGES

Engr.	T. Ed.	BA	Ag.	A & S
1.92	2.21	2.53	2.66	2.82

NOTE: Any two means not underscored by the same line are significantly different.

Any two means underscored by the same line are not significantly different.

Hypothesis I, Semester VIII: From Table XVIII the obtained F value for groups is found to be .32. The required value for significance was 2.53. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

Hypothesis II, Semester VIII: The F value from Table XVIII for Group by College interaction is .14. The required value for significance was 2.53, therefore, the null hypothesis was not rejected.

Hypothesis III, Semester VIII: In the absence of significant interaction, examination of the F value of 1.13 for colleges from Table XVIII is not significant, therefore, the null hypothesis was not rejected. Unadjusted and adjusted college means are presented in Table XIX.

Attention should be directed to the total absence of students in Group B, College of A & S, for semester eight. In the analysis of Covariance, this college was deleted and the appropriate degrees of freedom is reflected. The Arts and Sciences unadjusted and adjusted means reflects the presence of students in Group A only.

TABLE XVIII

ANALYSIS OF COVARIANCE OF COLLEGE GPA FOR MALES AND FEMALES SEMESTER EIGHT

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.137	.137	.321
Colleges	4	1.922	.481	1.130
G X C	3	.180	.060	.140
Regression	1	4.403	4.403	10.314
Within	65	27.755	.427	
Total	74	34.890		

TABLE XIX

GROUP AND COLLEGE GRADE POINT MEANS FOR MALES AND FEMALES SEMESTERS SEVEN AND EIGHT

	SEMESTER SEVEN		SEMESTER EIGHT	
	UNADJUSTED MEANS	ADJUSTED MEANS	UNADJUSTED MEANS	ADJUSTED MEANS
GROUP A	2.67	2.33	2.87	2.87
GROUP B	2.61	2.52	2.91	3.01
AG	2.87	2.66	2.96	3.09
A & S	2.80	2.82	3.04	2.99
ENGR.	2.35	1.92	2.58	2.59
T. ED.	2.54	2.21	3.00	3.10
BA	2.73	2.53	2.74	2.92
COMMON MEAN	2.65		2.89	

Testing of Hypotheses for Males Only

Hypothesis I: There is no significant difference in the mean grade point average between Group A and Group B when the ACT composite score is treated as a concomitant variable in an analysis of covariance.

Hypothesis I, Semester I: From Table XX the obtained F value for groups is found to be 2.25. The required value for significance was 3.84. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

Hypothesis II: There is no significant Group by College interaction when the ACT composite score is treated as a concomitant variable in an analysis of covariance.

Hypothesis II, Semester I: The F value from Table XX for Group by College interaction is . 17. The required value for significance was 2. 37, therefore, the null hypothesis was not rejected.

TABLE XX

ANALYSIS OF COVARIANCE OF COLLEGE GPA FOR MALES ONLY SEMESTER ONE

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	1. 375	1. 375	2. 25
Colleges	4	1. 053	. 263	. 43
G X C	4	. 424	. 106	. 17
Regression	1	48. 983	48. 983	80. 28
Within	308	187. 917	. 610	. 17
Total	318	293. 642		

Hypothesis III: There is no significant difference in the mean grade point average among the various colleges of the University when the ACT composite score is treated as a concomitant variable in an analysis of covariance.

Hypothesis III, Semester I: In the absence of significant interaction, examination of the F value of . 43 for colleges from Table XX is not significant, therefore, the null hypothesis was not rejected. Unadjusted and adjusted college means are presented in Table XXI.

Hypothesis I, Semester II: From Table XXII the obtained F value for groups is found to be . 16. The required value for significance was

3.84. Results of this *F* test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

TABLE XXI

GROUP AND COLLEGE GRADE POINT MEANS
FOR MALES ONLY
SEMESTERS ONE AND TWO

	SEMESTER ONE		SEMESTER TWO	
	UNADJUSTED MEANS	ADJUSTED MEANS	UNADJUSTED MEANS	ADJUSTED MEANS
GROUP A	2.14	1.97	2.27	2.03
GROUP B	1.32	1.77	1.56	1.97
AG	1.39	1.83	1.66	1.90
A & S	1.89	1.91	2.06	1.98
ENGR.	1.98	1.86	2.19	1.99
T. ED.	1.69	2.03	1.84	2.24
BA	1.52	1.73	1.68	1.90
COMMON MEAN	1.79		2.00	

Hypothesis II, Semester II: The *F* value from Table XXII for Group by College interaction is 1.27. The required value for significance was 2.37, therefore, the null hypothesis was not rejected.

Hypothesis III, Semester II: In the absence of significant interaction, examination of the *F* value of .37 for colleges from Table XXII is not significant, therefore, the null hypothesis was not rejected. Unadjusted and adjusted college means are presented in Table XXI.

TABLE XXII

ANALYSIS OF COVARIANCE OF COLLEGE GPA
FOR MALES ONLY
SEMESTER TWO

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.106	.106	.16
Colleges	4	.950	.238	.37
G X C	4	3.288	.822	1.27
Regression	1	26.951	26.951	41.64
Within	249	161.177	.647	
Total	259	229.342		

Hypothesis I, Semester III: From Table XXIII the obtained F value for groups is found to be .06. The required value for significance was 3.84. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

Hypothesis II, Semester III: The F value from Table XXIII for Group by College interaction is .96. The required value for significance was 2.37, therefore, the null hypothesis was not rejected.

Hypothesis III, Semester III: In the absence of significant interaction, examination of the F value of .50 for colleges from Table XXIII is not significant, therefore, the null hypothesis was not rejected. Unadjusted and adjusted college means are presented in Table XXIV.

Hypothesis I, Semester IV: From Table XXV the obtained F value for groups is found to be .006. The required value for significance was 3.84. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

TABLE XXIII

ANALYSIS OF COVARIANCE OF COLLEGE GPA FOR MALES ONLY SEMESTER THREE

Source of Variation	*df*	Sum of Squares	Variance Estimate	*F*
Groups	1	.037	.037	.06
Colleges	4	1.334	.334	.50
G X C	4	2.567	.642	.96
Regression	1	27.290	27.290	40.89
Within	184	122.802	.667	
Total	194	160.697		

TABLE XXIV

GROUP AND COLLEGE GRADE POINT MEANS FOR MALES ONLY SEMESTERS THREE AND FOUR

	SEMESTER THREE		SEMESTER FOUR	
	UNADJUSTED MEANS	ADJUSTED MEANS	UNADJUSTED MEANS	ADJUSTED MEANS
GROUP A	2.19	2.13	2.32	2.33
GROUP B	1.92	2.18	2.33	2.35
AG	1.99	2.16	2.47	2.54
A & S	2.20	2.15	2.42	2.39
ENGR.	2.14	2.01	2.26	2.28
T. ED.	1.81	2.03	2.06	2.03
BA	1.90	2.44	2.29	2.22
COMMON MEAN	2.10		2.32	

Hypothesis II, Semester IV: The F value from Table XXV for Group by College interaction is .49. The required value for significance was 2.37, therefore, the null nypothesis was not rejected.

Hypothesis III, Semester IV: In the absence of significant interaction, examination of the F value of .88 for colleges from Table XXV is not significant, therefore, the null hypothesis was not rejected. Unadjusted and adjusted college means are presented in Table XXIV.

TABLE XXV

ANALYSIS OF COVARIANCE OF COLLEGE GPA
FOR MALES ONLY
SEMESTER FOUR

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.004	.004	.006
Colleges	4	2.364	.591	.88
G X C	4	1.318	.329	.49
Regression	1	5.370	5.370	7.95
Within	151	101.989	.675	
Total	161	112.934		

Hypothesis I, Semester V: From Table XXVI the obtained F value fro groups is found to be .09. The required value for significance was 3.92. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

Hypothesis II, Semester V: The F value from Table XXVI for Group by College interaction is .62. The required value for significance was 2.45, therefore, the null hypothesis was not rejected.

TABLE XXVI

ANALYSIS OF COVARIANCE OF COLLEGE GPA FOR MALES ONLY SEMESTER FIVE

Source of Variation	*df*	Sum of Squares	Variance Estimate	*F*
Groups	1	.066	.066	.09
Colleges	4	5.815	1.454	1.96
G X C	4	1.850	.462	.62
Regression	1	3.956	3.956	5.34
Within	119	88.164	.741	
Total	129	100.030		

TABLE XXVII

GROUP AND COLLEGE GRADE POINT MEANS FOR MALES ONLY SEMESTERS FIVE AND SIX

	SEMESTER FIVE		SEMESTER SIX	
	UNADJUSTED MEANS	ADJUSTED MEANS	UNADJUSTED MEANS	ADJUSTED MEANS
GROUP A	2.42	2.41	2.55	2.63
GROUP B	2.27	2.49	2.34	2.46
AG	2.59	2.68	2.78	3.00
A & S	2.64	2.67	2.77	2.95
ENGR.	2.19	2.06	2.23	2.06
T. ED.	2.34	2.54	2.36	2.37
BA	2.16	2.30	2.32	2.33
COMMON MEAN	2.37		2.48	

Hypothesis III, Semester V: In the absence of significant interaction, examination of the *F* value of 1.96 for colleges from Table XXVI is not significant, therefore, the null hypothesis was not rejected. Unadjusted and adjusted college means are presented in Table XXVII.

TABLE XXVIII

ANALYSIS OF COVARIANCE OF COLLEGE GPA
FOR MALES ONLY
SEMESTER SIX

Source of Variation	*df*	Sum of Squares	Variance Estimate	*F*
Groups	1	.267	.267	.44
Colleges	4	10.543	2.636	4.34
G X C	4	1.942	.485	.80
Regression	1	2.801	2.801	4.62
Within	92	55.820	.607	
Total	102	70.256		

Hypothesis I, Semester VI: From Table XXVIII the obtained *F* value for groups is found to be .44. The required value for significance was 3.92. Results of this *F* test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

Hypothesis II, Semester VI: The *F* value from Table XXVIII for Group by College interaction is .80. The required value for significance was 2.45, therefore, the null hypothesis was not rejected.

Hypothesis III, Semester VI: In the absence of significant interaction, examination of the *F* value of 4.34 for colleges from Table XXVIII was significant beyond the .01 level; therefore, the null hypothesis was rejected. Unadjusted and adjusted college means are presented in Table XXVII.

Due to the significant F value for colleges, Duncan's New Multiple Range Test was applied to the data to locate the differences. The results of this test are presented in Table XXIX.

TABLE XXIX

MULTIPLE RANGE TEST OF COLLEGE MEANS
FOR MALES ONLY
SEMESTER SIX

ADJUSTED MEANS FOR COLLEGES

Engr.	BA	T. Ed..	A & S	Ag.
2.06	2.33	2.37	2.95	3.00

NOTE: Any two means not underscored by the same line are significantly different.

Any two means underscored by the same line are not significantly different.

Hypothesis I, Semester VII: From Table XXX the obtained F value for groups is found to be .22. The required value for significance was 4.00. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

Hypothesis II, Semester VII: The F value from Table XXX for Group by College interaction is .19. The required value for significance was 2.76, therefore, the null hypothesis was not rejected.

Hypothesis III, Semester VII: In the absence of significant interaction, examination of the F value of 2.35 for colleges from Table XXX is not significant; therefore, the null hypothesis was not rejected. Unadjusted and adjusted college means are presented in Table XXXI.

TABLE XXX

ANALYSIS OF COVARIANCE OF COLLEGE GPA
FOR MALES ONLY
SEMESTER SEVEN

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.138	.138	.22
Colleges	4	5.835	1.459	2.35
G X C	3	.348	.116	.19
Regression	1	7.758	7.758	12.51
Within	69	42.783	.620	.
Total	78	56.709		

Hypothesis I, Semester VIII: From Table XXXII the obtained F value for groups is found to be .08. The required value for significance was 4.08. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

Hypothesis II, Semester VIII: The F value from Table XXXII for Group by College interaction is .08. The required value for significance was 3.23; therefore, the null hypothesis was not rejected.

Hypothesis III, Semester VIII: In the absence of significant interaction, examination of the F value of 1.13 for colleges from Table XXXII is not significant; therefore,the null hypothesis was not rejected. Unadjusted and adjusted college means are presented in Table XXXI.

TABLE XXXI

GROUP AND COLLEGE GRADE POINT MEANS FOR MALES ONLY SEMESTERS SEVEN AND EIGHT

	SEMESTER SEVEN		SEMESTER EIGHT	
	UNADJUSTED MEANS	ADJUSTED MEANS	UNADJUSTED MEANS	ADJUSTED MEANS
GROUP A	2.54	2.62	2.80	2.85
GROUP B	2.55	2.45	2.92	2.95
AG	2.88	3.04	3.03	3.15
A & S	2.59	2.26	3.09	2.94
ENGR.	2.35	2.27	2.59	2.55
T. ED.	2.34	2.15	2.64	2.73
BA	2.73	2.96	2.82	3.12
COMMON MEAN	2.54		2.83	

TABLE XXXII

ANALYSIS OF COVARIANCE OF COLLEGE GPA FOR MALES ONLY SEMESTER EIGHT

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.040	.040	.08
Colleges	4	2.185	.546	1.13
G X C	2	.138	.069	.08
Regression	1	4.843	4.843	9.99
Within	42	20.358	.485	
Total	50	28.018		

Testing of Hypotheses for Females Only

In factoring the female subsample into two groups and four colleges, there were semesters during which classification reduced the N of a particular cell below the feasible point for testing. When this occurred, these classifications were deleted from the analysis and the degrees of freedom for colleges and interaction were corrected.

Hypothesis I: There is no significant difference in the mean grade point average between Group A and Group B when the ACT composite score is treated as a concomitant variable in an analysis of covariance.

Hypothesis I, Semester I: From Table XXXIII the obtained *F* value for groups is found to be 1.69. The required value for significance was 3.92. Results of this *F* test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

TABLE XXXIII

ANALYSIS OF COVARIANCE OF COLLEGE GPA
FOR FEMALES ONLY
SEMESTER ONE

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	1.190	1.190	1.69
Colleges	3	.519	.173	.25
G X C	2	.941	.470	.67
Regression	1	17.984	17.984	25.50
Within	127	89.583	.705	.
Total	134	129.594		

Hypothesis II, Semester I: The *F* value from Table XXXIII for

Group by College interaction is .67. The required value for significance was 3.07; therefore, the null hypothesis was not rejected.

Hypothesis III, Semester I: In the absence of significant interaction, examination of the F value of .25 for colleges from Table XXXIII is not significant; therefore, the null hypothesis was not rejected. Unadjusted and adjusted college means are presented in Table XXXIV.

TABLE XXXIV

GROUP AND COLLEGE GRADE POINT MEANS
FOR FEMALES ONLY
SEMESTERS ONE AND TWO

	SEMESTER ONE		SEMESTER TWO	
	UNADJUSTED MEANS	ADJUSTED MEANS	UNADJUSTED MEANS	ADJUSTED MEANS
GROUP A	2.44	2.13	2.61	2.16
GROUP B	1.62	1.83	1.77	1.97
AG	1.63	1.96	1.71	1.92
A & S	2.06	1.97	2.36	2.25
T. ED.	1.91	1.88	2.00	1.96
BA	1.72	2.12	1.55	2.12
COMMON MEAN	1.91		2.10	

Hypothesis I, Semester II: From Table XXXV the obtained F value for groups is found to be .84. The required value for significance was 3.94. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

Hypothesis II, Semester II: The F value from Table XXXV for

Group by College interaction is .66. The required value for significance was 3.09; therefore, the null hypothesis was not rejected.

Hypothesis III, Semester II: In the absence of significant interaction, examination of the F value of 1.23 for colleges from Table XXXV is not significant; therefore, the null hypothesis was not rejected. Unadjusted and adjusted college means are presented in Table XXXIV.

TABLE XXXV

ANALYSIS OF COVARIANCE OF COLLEGE GPA
FOR FEMALES ONLY
SEMESTER TWO

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.489	.489	.84
Colleges	3	2.150	.717	1.23
G X C	2	.774	.387	.66
Regression	1	19.157	19.157	32.89
Within	103	59.992	.582	
Total	110	101.736		

Hypothesis I, Semester III: From Table XXXVI the obtained F value for groups is found to be 1.90. The required value for significance was 4.00. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

Hypothesis II, Semester III: The F value from Table XXXVI for Group by College interaction is 1.11. The required value for significance was 2.76; therefore, the null hypothesis was not rejected.

Hypothesis III, Semester III: In the absence of significant interaction, examination of the F value for colleges from Table XXXVI reveals a value of 3.37 which was significant at the .05 level. The results of this F test led to a conclusion that significant differences did exist in the grade point means among the various colleges of the university. Unadjusted and adjusted college means are presented in Table XXXIX.

Due to the significant F value for colleges, Duncan's New Multiple Range Test was applied to the data to locate the differences. The results of this test are presented in Table XXXVII.

TABLE XXXVI

ANALYSIS OF COVARIANCE OF COLLEGE GPA FOR FEMALES ONLY SEMESTER THREE

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	1.057	1.057	1.90
Colleges	3	5.639	1.880	3.37
G X C	3	1.847	.616	1.11
Regression	1	10.306	10.306	18.50
Within	63	35.099	.557	
Total	71	58.982		

Hypothesis I, Semester IV: From Table XXXVIII the obtained F value for groups is found to be .81. The required value for significance was 4.08. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

Hypothesis II, Semester IV: The F value from Table XXXVIII for Group by College interaction is .16. The required value for significance was 2.84; therefore, the null hypothesis was not rejected.

TABLE XXXVII

MULTIPLE RANGE TEST OF COLLEGE MEANS
FOR FEMALES ONLY
SEMESTER THREE

ADJUSTED MEANS FOR COLLEGES

Ag.	BA	T. Ed.	A & S
1.67	1.72	1.90	2.41

NOTE: Any two means not underscored by the same line are significantly different.

Any two means underscored by the same line are not significantly different.

TABLE XXXVIII

ANALYSIS OF COVARIANCE OF COLLEGE GPA
FOR FEMALES ONLY
SEMESTER FOUR

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.332	.332	.81
Colleges	3	1.477	.492	1.21
G X C	3	.201	.067	.16
Regression	1	10.010	10.010	24.52
Within	50	20.419	.408	.
Total	58	37.677		

Hypothesis III, Semester IV: In the absence of significant interaction, examination of the F value of 1.21 for colleges from Table XXXVIII is not significant; therefore, the null hypothesis was not rejected. Unadjusted and adjusted college means are presented in Table XXXIX.

TABLE XXXIX

GROUP AND COLLEGE GRADE POINT MEANS FOR FEMALES ONLY SEMESTERS THREE AND FOUR

	SEMESTER THREE		SEMESTER FOUR	
	UNADJUSTED MEANS	ADJUSTED MEANS	UNADJUSTED MEANS	ADJUSTED MEANS
GROUP A	2.41	1.70	2.72	2.17
GROUP B	1.98	2.14	2.16	2.42
AG	1.93	1.67	2.16	2.07
A & S	2.45	2.41	2.41	2.09
T. ED.	1.90	1.90	2.67	2.53
BA	1.67	1.72	2.34	2.50
COMMON MEAN	2.18		2.44	

Hypothesis I, Semester V: From Table XL the obtained *F* value for groups is found to be .01. The required value for significance was 4.17. Results of this *F* test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

Hypothesis II, Semester V: The *F* value from Table XL for Group by College interaction is .57. The required value for significance was 2.92; therefore, the null hypothesis was not rejected.

Hypothesis III, Semester V: In the absence of significant interaction, examination of the *F* value of 1.58 for colleges from Table XL is not significant; therefore, the null hypothesis was not rejected. Unadjusted and adjusted college means are presented in Table XLIII.

TABLE XL

ANALYSIS OF COVARIANCE OF COLLEGE GPA FOR FEMALES ONLY SEMESTER FIVE

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.002	.002	.01
Colleges	3	1.854	.618	1.58
G X C	3	.669	.223	.57
Regression	1	2.954	2.954	7.56
Within	32	12.503	.391	.
Total	40	25.568		

Hypothesis I, Semester VI: From Table XLI the obtained F value for groups is found to be 4.90. The required value for significance was 4.17. Results of this F test led to a conclusion that significant differences did exist between the mean grade point averages of Groups A and B, and the null hypothesis was rejected.

Hypothesis II, Semester VI: The F value from Table XLI for Group by College interaction is 1.72. The required value for significance was 2.92; therefore, the null hypothesis was not rejected.

Hypothesis III, Semester VI: In the absence of significant interaction, examination of the F value of 2.97 for colleges from Table XLI was significant, therefore, the null hypothesis was rejected. Unadjusted and adjusted college means are presented in Table XLIII. Due to the significant F value for colleges, Duncan's New Multiple Range Test was again applied to locate the differences. The results of this test are presented in Table XLII.

TABLE XLI

ANALYSIS OF COVARIANCE OF COLLEGE GPA FOR FEMALES ONLY SEMESTER SIX

Source of Variation	*df*	Sum of Squares	Variance Estimate	*F*
Groups	1	1.647	1.647	4.90
Colleges	3	2.996	.999	2.97
G X C	3	1.738	.579	1.72
Regression	1	3.220	3.220	9.58
Within	30	10.088	.336	
Total	38	19.889		

TABLE XLII

MULTIPLE RANGE TEST OF COLLEGE MEANS FOR FEMALES ONLY SEMESTER SIX

BA	Ag.	T. Ed.	A & S
1.95	2.31	2.67	3.00

NOTE: Any two means not underscored by the same line are significantly different.

Any two means underscored by the same line are not significantly different.

Hypothesis I, Semester VII: From Table XLIV the obtained *F* value for groups is found to be .19. The required value for significance was 4.26. Results of this *F* test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

TABLE XLIII

GROUP AND COLLEGE GRADE POINT MEANS FOR FEMALES ONLY SEMESTERS FIVE AND SIX

	SEMESTER FIVE		SEMESTER SIX	
	UNADJUSTED MEANS	ADJUSTED MEANS	UNADJUSTED MEANS	ADJUSTED MEANS
GROUP A	2.88	2.36	2.85	2.15
GROUP B	2.17	2.34	2.48	2.82
AG	2.45	2.34	2.51	2.31
A & S	2.83	2.63	2.95	3.00
T. ED.	2.62	2.62	2.66	2.67
BA	1.58	1.81	2.00	1.95
COMMON MEAN	2.57		2.68	

TABLE XLIV

ANALYSIS OF COVARIANCE OF COLLEGE GPA FOR FEMALES ONLY SEMESTER SEVEN

Source of Variation	*df*	Sum of Squares	Variance Estimate	*F*
Groups	1	.058	.058	.19
Colleges	2	1.418	.709	2.34
G X C	1	.819	.819	2.70
Regression	1	.106	.106	.35
Within	24	7.285	.304	
Total	29	10.512		

Hypothesis II, Semester VII: The *F* value from Table XLIV for

Group by College interaction is 2.70. The required value for significance was 4.26, therefore, the null hypothesis was not rejected.

Hypothesis III, Semester VII: In the absence of significant interaction, examination of the F value of 2.34 for colleges from Table XLIV is not significant, therefore, the null hypothesis was not rejected. Unadjusted and adjusted college means are presented in Table XLV.

TABLE XLV

GROUP AND COLLEGE GRADE POINT MEANS
FOR FEMALES ONLY
SEMESTERS SEVEN AND EIGHT

	SEMESTER SEVEN		SEMESTER EIGHT	
	UNADJUSTED MEANS	ADJUSTED MEANS	UNADJUSTED MEANS	ADJUSTED MEANS
GROUP A	3.06	2.80	3.07	2.99
GROUP B	2.70	2.93	2.90	2.94
AG	2.81	2.63	2.79	2.76
A & S	3.23	3.25	2.99	2.93
T. ED.	2.73	2.70	3.27	3.22
BA	2.67		2.33	
COMMON MEAN	2.94		3.02	

Hypothesis I, Semester VIII: From Table XLVI the obtained F value for groups is found to be .02. The required value for significance was 4.41. Results of this F test led to a conclusion that no significant difference existed between the mean grade point averages of Groups A and B, and the null hypothesis was not rejected.

Hypothesis II, Semester VIII: The F value from Table XLVI for

Group by College interaction is .14. The required value for significance was 4.41, therefore, the null hypothesis was not rejected.

Hypothesis III, Semester VIII: In the absence of significant interaction, examination of the F value of 1.17 for colleges from Table XLVI is not significant, therefore, the null hypothesis was not rejected. Unadjusted and adjusted college means are presented in Table XLV.

TABLE XLVI

ANALYSIS OF COVARIANCE OF COLLEGE GPA
FOR FEMALES ONLY
SEMESTER EIGHT

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.007	.007	.02
Colleges	2	.689	.345	1.17
G X C	1	.041	.041	.14
Regression	1	.051	.051	.17
Within	18	5.295	.294	
Total	23	6.293		

Summary

A tabular summary of the disposition of each hypothesis for the eight semesters on the total sample, the male subsample, and the female subsample follows in Table XLVII, Table XLVIII, and Table XLIX. Discussion of the results and the conclusions drawn are presented in Chapter V.

TABLE XLVII

DISPOSITION OF HYPOTHESIS I FOR THE TOTAL, MALE, AND FEMALE GROUPS

HYPOTHESIS I: There is no significant difference in the mean grade point average between Group A and Group B when the ACT composite score is treated as a concomitant variable in an analysis of covariance.

SEMESTER	TOTAL SAMPLE	MALE SUBSAMPLE	FEMALE SUBSAMPLE
I	Do not reject	Do not reject	Do not reject
II	Do not reject	Do not reject	Do not reject
III	Do not reject	Do not reject	Do not reject
IV	Do not reject	Do not reject	Do not reject
V	Do not reject	Do not reject	Do not reject
VI	Do not reject	Do not reject	Reject
VII	Do not reject	Do not reject	Do not reject
VIII	Do not reject	Do not reject	Do not reject

TABLE XLVIII

DISPOSITION OF HYPOTHESIS II FOR THE TOTAL, MALE, AND FEMALE GROUPS

HYPOTHESIS II: There is no significant Group by College interaction when the ACT composite score is treated as a concomitant variable in an analysis of covariance.

SEMESTER	TOTAL SAMPLE	MALE SUBSAMPLE	FEMALE SUBSAMPLE
I	Do not reject	Do not reject	Do not reject
II	Do not reject	Do not reject	Do not reject
III	Do not reject	Do not reject	Do not reject
IV	Do not reject	Do not reject	Do not reject
V	Do not reject	Do not reject	Do not reject
VI	Do not reject	Do not reject	Do not reject
VII	Do not reject	Do not reject	Do not reject
VIII	Do not reject	Do not reject	Do not reject

TABLE XLIX

DISPOSITION OF HYPOTHESIS III FOR THE TOTAL, MALE, AND FEMALE GROUPS

HYPOTHESIS III: There is no significant difference in the mean grade point average of students among the various colleges of the University when the ACT composite score is treated as a concomitant variable in an analysis of covariance.

SEMESTER	TOTAL SAMPLE	MALE SUBSAMPLE	FEMALE SUBSAMPLE
I	Do not reject	Do not reject	Do not reject
II	Do not reject	Do not reject	Do not reject
III	Do not reject	Do not reject	Reject
IV	Do not reject	Do not reject	Do not reject
V	Reject	Do not reject	Do not reject
VI	Reject	Reject	Reject
VII	Reject	Do not reject	Do not reject
VIII	Do not reject	Do not reject	Do not reject

CHAPTER V

DISCUSSION, LIMITATIONS, AND CONCLUSIONS

Discussion of the Combined Male and Female Sample

In considering Hypothesis I for the total population of no significant difference in the mean Grade point averages between groups after adjusting for differences in the ACT composite score, it was found that no significant difference did exist for any of the eight semesters.

An analysis of variance testing for the significance of difference between groups on the various ACT subtests and on the composite score revealed the following information. However, in considering this information, one should recall that the composition of the two groups was dynamic because of the dropouts which occurred each semester.

During the first six semesters there was a significant difference between groups on each of the subtests, and on the composite score of the American College Test. In each instance, Group A had the higher scores. The seventh semester analysis revealed no significant difference between Groups on the English subtest. The eighth semester analysis revealed no significant difference between Groups on the English, social studies, natural science and composite scores. In all other cases Group A excelled over Group B on the ability to perform college tasks as measured by the American College Test.

The _F_ values from the analysis of variance for the difference between Groups on the ACT composite score was 95.92, 66.89, 35.16, 53.80, 45.09, 34.60, 7.73, and 3.96 for semesters one through eight consecutively. Thus, it can be seen that the two groups tended to become more homogeneous in ability as the dropouts occurred.

An analysis of the ACT composite scores between the original Groups as they were comprised for semester one revealed that, from the original N of 228 for Group A and 226 for Group B, there were 121 students in each Group with identical ACT composite scores.

The difference in GPA for the two Groups also revealed a trend to smaller differences as the groups became more homogeneous in ability. An analysis of variance for the difference in mean GPA for the two groups revealed the following F values for semesters one through eight consecutively: 30.77, 21.68, 3.09, 2.60, 5.02, 4.18, .10, and .04.

Closer examination of these analyses of variance F values indicates that even though the ability to achieve, as measured by the ACT composite score, was significantly higher in each case, with the exception of semester eight for Group A, there was no significant difference in achievement between the two groups for semesters three, four, seven, and eight. The difference in achievement for semesters five and six was significant at less than the .025 level of probability as associated with the appropriate degrees of freedom.

Correlation coefficients between the ACT composite score and college GPA ranged from a high of .45 for semester one to a low of .24. The median coefficient was .36 which is in accord with results found in similar studies.

An analysis of variance was also conducted in an effort to determine the effect of the number of semester hours attempted by the two groups upon their Grade Point Averages. Results indicated that only during semesters one and three was there a significant difference in the number of hours attempted by Group A and Group B.

Group A attempted a mean of 15.82 hours for the first semester while Group B attempted 15.06. During semester three, Group A attempted 15.19 hours while Group B attempted 14.45 hours. Although these differences are statistically significant at the .05 level, questions could be raised concerning the actual effect upon achievement of these differences in semester hour loads. Correlation coefficients between the number of hours attempted and the mean GPA ranged from a high of .32 to a low of -.19, with a median coefficient of .19. This coefficient would account for only 3.61 percent of the total variance in achievement.

The dropout rate for Group A was lower than for Group B. From semester one to semester two, the dropout rate was eleven percent for Group A and 26 percent for Group B. Semester two to semester three revealed a dropout rate of 19 percent for Group A and 39 percent for Group B. Only eight percent of Group B completed eight consecutive semesters at New Mexico State University, whereas 25 percent of Group A completed eight consecutive semesters. The data did not indicate whether these dropouts entered another institution of higher learning.

The Group by college interaction was not significant for any of the eight covariance analyses, indicating that the two groups performed independently of colleges in respect to achievement. Similar results were also obtained from the analyses of variance.

The _F_ values for colleges obtained from the eight analyses of covariance revealed significant differences for semesters five, six, and seven only. The results of Duncan's test for differences among adjusted college means for semesters five, six, and seven may be reviewed from Table XIII, page 49, Table XV, page 50, Table XVII, page 52.

These differences indicated, that assuming equal ability as measured by the ACT, there were significant differences in college grade point means for these three semesters.

Analyses of variance revealed that in actual unadjusted college grade point means there was a significant difference for semester six only. There were significant differences on the ACT composite score between the different colleges of the university for six of the eight semesters; yet the analysis of variance did not show significant differences among these college grade point means for seven of the eight semesters. Consideration should be given to the fact that Group by College interaction was significant on the six analyses of variance which indicated the differences in ability of the students in the various colleges. However, one must also consider the very large differences in ability between the groups as measured by the ACT, and the corresponding low F values for the interaction. The extended range of difference in ability between the two groups would be expected to yield a higher interaction term than would a smaller range in ability. The F values from the analyses of variance of the ACT composite score are presented in Appendix B, page 97. These factors lead to the consideration of the following possible hypotheses:

A. The ACT Test is not accurately predicting the achievement for these students as they are differentiated among the colleges of the university.

B. The grading practices are not uniform among the colleges of the university.

C. Unknown and/or uncontrolled variables are interacting with relation to ability and achievement.

It should be noted that the ranked unadjusted college grade point means and the ranked ACT scores for colleges revealed a correlation of +1.0 for the first semester, thus indicating the predictive validity of the ACT composite score was highly efficient for the first semester but did not maintain the same predictive efficiency over a longitudinal period.

Over an eight semester period the unadjusted college means tend to support the thesis that in relation to ability as measured by the ACT, students in the college of Engineering are receiving lower grades than would be expected whereas students in the college of Agriculture are receiving higher grades than would be expected. The reader is again reminded to the Hypotheses previously presented concerning the possible explanation of these results.

As presented in Chapter III on "methodology and procedure," Analyses of Variance were conducted concomitantly with all analyses of covariance. It seems significant to note that these analyses of variance, presented in Appendix C, supported the conclusions drawn from the analyses of covariance.

Discussion of the Male Only and Female Only Samples

The separate male only and female only samples did not appear to perform differently from the combined male--female sample. Concerning ability, the females were more homogeneous but less able to perform college tasks, as measured by the ACT. However, unadjusted grade point means indicated that the females consistently achieved higher averages than did the males.

The analyses of covariance of difference in achievement between Group A and Group B were not significant for any of the eight semesters for the male sample. A significant difference was indicated for semester six only for the female sample, and in this instance the adjusted grade point mean for Group B exceeded that of Group A.

Analyses of Variance indicated significant differences in achievement between Group A and Group B during the first year only, for both the male and the female samples. After the first year of college, actual achievement between groups was not significantly different.

The females were more evenly distributed according to ability among the various colleges of the university; therefore, the Group by College interaction was higher for the male sample.

Combined male and female analyses indicated differences in adjusted college means for semesters five, six, and seven. The male only analyses yielded a significant *F* value for semester six only, while the female analyses were significant for semesters three and six. These inconsistencies would appear to be the result of the variant sensitivity of the *F* test with different numbers of observations and to the particular differences of the male only and female only samples compensating or offsetting each other.

Limitations

Before reaching conclusions concerning this study, it is appropriate to consider the limitations involved.

The first limitation concerns the danger of generalizing, uncritically, the findings. Though the study dealt with a specific type of population---college students of New Mexico State University---no statistical evidence is available to indicate that this population is typical of any larger group of college students.

Another limitation concerns the use of covariance. The use of this statistical procedure, by definition, creates an artificial situation. Whether one would find these conditions in reality, and whether the same results would actually occur is speculative. The use of the American College Test composite score as the concomitant variable deserves comment. Whether the test measures ability or achievement is the critical question. There appears to be no correct, acceptable to all, answer to this question. After thoroughly researching the correlation of the ACT composite score to an acceptable intelligence test score, it is the opinion of this writer that this is not a serious limitation.

Although the procedure selected for the analysis of the data made statistical adjustments for un-equal subclass numbers, it is felt that the limited subclass observations, in some instances, places restrictions upon the resulting conclusions. A complete listing of the number of observations for each class and subclass may be found in Appendix D, page 112. This limitation would apply to the college grade point means and the group by college interactions for the male-only and female-only conclusions. The number of observations appeared adequate when the male and female subsamples were combined for the primary analyses.

Conclusions Concerning the Combined Male and Female Population

The analysis of the data would tend to lead to the acceptance of the following statements concerning the differences between Groups, between colleges, and the interaction of these two factors for the total population.

1. The two groups were highly different in their ability to perform college tasks as measured by the American College Test, with Group A excelling over Group B.

2. Over 50 percent of the students achieved equally well on the American College Test, even in view of the difference in high school backgrounds.

3. The difference in the number of hours of credit attempted by the two groups did not appear to be a decisive factor affecting college GPA.

4. When the difference in ability was adjusted to a common mean in an analysis of covariance, the achievement of the two Groups was not significantly different.

5. A higher percentage of Group B students left New Mexico State University before completing eight semesters of instruction. A follow-up on dropouts was not included in this study.

6. The first year of college appears to be the most critical period concerning the relation of achievement between the two groups. After the first year, differences in achievement were smaller.

7. The Group by college interaction values were not significant in the analyses of variance or the analyses of covariance, indicating that achievement was not dependent upon a certain combination of group and college.

8. With ability, as indicated by the American College Test, adjusted to a common mean among colleges, no significant difference in grade point average was attained by the student during semesters one, two, three, four, and eight, due to his selection of a particular college.

   Significant differences in adjusted college grade point means did exist during semesters five, six, and seven. These differences were not consistent each semester. A composite of the ranked grade point means for the three semesters shows the colleges to be in the following order from high to low on grade point means: (1) Arts and Sciences, (2) Agriculture, (3) Teacher Education, (4) Business Administration, and (5) Engineering.

9. Analyses of variance between Groups revealed no significant differences in achievement for four of the eight semesters.

10. The data does not tend to indicate that the high school

background is highly critical to college success, but tends to indicate that general intelligence and non-intellective factors are more decisive to college achievement.

Conclusions Concerning the Male-Only and Female-Only Populations

Analysis of the data would appear to warrant the following conclusions concerning the separate male and female populations:

1. The separate male-only and female-only samples appeared to be from the same population as the combined male-female sample.

2. When the ability of the two groups, as measured by the ACT, was adjusted to a common mean in an analysis of covariance, there was no significant difference in achievement.

3. *Analysis of Variance* indicated significant differences in achievement for the Freshman year of college only. The remaining three years of college indicated no significant differences in achievement.

4. The group by college interaction values were not significant for either the males or females, indicating that achievement was not dependent upon a certain combination of group and college.

5. With ability, as indicated by the American College Test, adjusted to a common mean among colleges, significant differences in college grade point means existed only in three isolated instances.

Recommendations

It appears desirable that future research studies conducted in the area of high school background and college achievement be designed so that more rigid control can be exercised. Selection procedures in utilizing random selection of subjects would enable greater generalization of the findings.

Ability testing of students at the pre-high school level could eliminate the use of statistical controls in this area.

The effect of the high school curriculum upon college dropout rate should be more thoroughly investigated.

This investigation began with approximately nine hundred students. When factored into two groups and five colleges, and after dropouts occurred, cell observations dropped below a desirable number. Future studies should lend serious consideration to this information.

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APPENDIX A

DATA COLLECTION INSTRUMENT

VITA

Marion Gilbert Ashcraft

Candidate for the Degree of

Doctor of Education

Thesis: THE EFFECT OF THE HIGH SCHOOL CURRICULUM UPON COLLEGE ACHIEVEMENT

Major Field: Student Personnel and Guidance

Biographical:

Personal Data: Born in Ranger, Texas; June 11, 1932; the son of Ray O. and Nellie Ashcraft.

Education: Attended grade schools in Plains, Texas, and Lovington, New Mexico; graduated from Lovington High School in 1950; received the Bachelor of Science degree from New Mexico State University (then New Mexico College of Agriculture and Mechanic Arts) in 1954; received the Master of Arts degree in 1959 from New Mexico State University. The requirements for the Doctor of Education degree were completed in December 1967, at Oklahoma State University.

Professional Experience: Employed as vocational agriculture instructor at Moriarty High School, Moriarty, New Mexico from September 1954 to August 1956; employed by the Clayton Public Schools, Clayton, New Mexico, as vocational agriculture and general science teacher from September 1956 through August 1964; attended the 1964-65 academic year N. D. E. A. Counseling Institute at Oklahoma State University; employed July 1965 by New Mexico State University as Assistant Director and Counselor of the Alamogordo Branch, a position which is currently held.

Professional Organizations: American Educational Research Association, American Personnel and Guidance Association, National Vocational Guidance Association, New Mexico School Counselors Association, New Mexico Education Association, National Education Association, New Mexico Council for the Improvement of Education, Phi Delta Kappa.

HIGH SCHOOL AND COLLEGE SUMMARY

High School Credits

College Preparatory

English ______
Algebra ______
Geometry ______
Trig ______
Biology ______
Chemistry ______
Gen. Science ______
Physics ______
Advanced Science ______
American History ______
World History ______
Ancient History ______
Modern History ______
Civics ______
Economics ______
Sociology ______
French ______
Latin ______
Spanish ______
Speech ______
Journalism ______
Others ______
______
______
______

Total ______

Non-College Preparatory

Agriculture ______
Home Economics ______
Mec. Drawing ______
Bookkeeping ______
Typing ______
Shorthand ______
Office Practice ______
Music ______
P. E. ______
Auto Mechanics ______
Wood Shop ______
Ceramics ______
Lapidary ______
General Math ______
Driver Training ______
Others ______
______

Total ______

College Credits

Sem.	Hours Attempted	Grade Points Earned	Enrolled in College
1			
2			
3			
4			
5			
6			
7			
8			

College Code
1=AG
2=A&S
3=Engr.
4=T. Ed.
5=BA

Student No. ______

Sex ______

Graduated ______

Grand Total ______

Percent Academic Background ______

ACT SCORES

______ Eng.
______ Math
______ N.S.
______ S.S.
______ Comp.

APPENDIX B

F VALUES FROM THE ANALYSIS OF VARIANCE OF THE ACT COMPOSITE SCORE

TABLE L

F VALUES FROM THE ANALYSIS OF VARIANCE OF THE ACT COMPOSITE SCORE SEMESTERS ONE THROUGH EIGHT

	SEMESTER NUMBER							
	1	2	3	4	5	6	7	8
MALES AND FEMALES								
GROUPS	95.92**	66.89**	35.16**	53.80**	45.09**	34.60**	7.73**	3.96
COLLEGES	5.17**	4.54**	4.31**	3.65**	2.64*	1.57	1.58	2.54*
G X C	2.52*	4.95**	5.29**	4.91**	2.85*	2.96*	1.51	.73
MALES ONLY								
GROUPS	57.23**	32.24**	13.92**	37.76**	33.18**	23.13**	8.75**	1.69
COLLEGES	5.61**	4.39**	4.74**	4.66**	3.24*	2.34	3.12*	2.72*
G X C	2.58*	3.48*	3.28*	3.71**	2.20	2.35	1.60	.33
FEMALES ONLY								
GROUPS	25.29**	26.27**	14.61**	10.79**	8.64**	11.92**	1.89	.74
COLLEGES	1.30	1.81	.52	.34	.37	.53	1.22	.74
G X C	.85	3.46*	2.73*	2.26	1.66	2.17	4.44*	2.64

* Significant at .05
** Significant at .01

APPENDIX C

STATISTICAL TABLES

TABLE LI

ANALYSIS OF VARIANCE OF COLLEGE GPA FOR MALES AND FEMALES

SEMESTER ONE

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	24.354	24.354	30.77**
Colleges	4	4.430	1.107	1.40
G X C	4	2.692	.673	.85
Within	444	351.425	.791	
Total	453	424.615		

SEMESTER TWO

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	16.737	16.737	21.68**
Colleges	4	5.738	1.434	1.86
G X C	4	2.508	.627	.81
Within	361	278.686	.772	
Total	370	331.783		

TABLE LI (Continued)

SEMESTER THREE

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	2.409	2.409	3.09
Colleges	4	5.465	1.366	1.75
G X C	4	8.407	2.102	2.69*
Within	257	200.417	.780	
Total	266	220.013		

SEMESTER FOUR

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	1.769	1.769	2.60
Colleges	4	.107	.027	.04
G X C	4	5.025	1.256	1.85
Within	211	143.524	.680	
Total	220	151.249		

TABLE LI (Continued)

SEMESTER FIVE

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	3.486	3.486	5.02*
Colleges	4	5.939	1.485	2.14
G X C	4	1.752	.438	.63
Within	161	111.837	.695	
Total	170	126.837		

SEMESTER SIX

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	2.427	2.427	4.18*
Colleges	4	10.542	2.636	4.53*
G X C	4	1.888	.472	.81
Within	132	76.721	.581	
Total	141	91.202		

TABLE LI (Continued)

SEMESTER SEVEN

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.064	.064	.10
Colleges	4	5.183	1.296	2.04
G X C	4	1.746	.436	.69
Within	99	62.979	.636	
Total	108	70.685		

SEMESTER EIGHT

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.018	.018	.04
Colleges	4	1.710	.427	.88
G X C	3	.303	.101	.21
Within	66	32.158	.487	
Total	74	34.890		

* Significant at .05

** Significant at .01

TABLE LII

ANALYSIS OF VARIANCE OF COLLEGE GPA FOR MALES ONLY

SEMESTER ONE

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	18.394	18.394	23.99**
Colleges	4	3.857	.964	1.26
G X C	4	1.276	.319	.41
Within	309	236.900	.767	
Total	318	293.642		

SEMESTER TWO

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	4.885	4.885	6.49*
Colleges	4	3.096	.774	1.03
G X C	4	6.467	1.617	2.15
Within	250	188.128	.753	
Total	259	229.342		

TABLE LII (Continued)

SEMESTER THREE

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	1.523	1.523	1.88
Colleges	4	1.110	.278	.34
G X C	4	5.420	1.355	1.67
Within	185	150.092	.811	
Total	194	160.697		

SEMESTER FOUR

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	1.173	1.173	1.66
Colleges	4	2.543	.636	.90
G X C	4	3.259	.815	1.15
Within	152	107.359	.706	
Total	161	112.934		

TABLE LII (Continued)

SEMESTER FIVE

Source of Variation	*df*	Sum of Squares	Variance Estimate	*F*
Groups	1	.571	.571	.74
Colleges	4	4.618	1.154	1.50
G X C	4	1.111	.278	.36
Within	120	92.120	.768	
Total	129	100.030		

SEMESTER SIX

Source of Variation	*df*	Sum of Squares	Variance Estimate	*F*
Groups	1	1.994	1.994	3.16
Colleges	4	9.806	2.452	3.89**
G X C	4	1.337	.334	.53
Within	93	58.621	.630	
Total	102	70.256		

TABLE LII (Continued)

SEMESTER SEVEN

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	1.902	1.902	2.63
Colleges	4	5.324	1.331	1.84
G X C	3	1.319	.440	.61
Within	70	50.541	7.220	
Total	78	56.709		

SEMESTER EIGHT

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.054	.054	.09
Colleges	4	1.772	.443	.76
G X C	2	.404	.202	.35
Within	43	25.200	.586	
Total	50	28.018		

* Significant at .05

** Significant at .01

TABLE LIII

ANALYSIS OF VARIANCE OF COLLEGE GPA FOR FEMALES ONLY

SEMESTER ONE

Source of Variation	*df*	Sum of Squares	Variance Estimate	*F*
Groups	1	9.479	9.479	11.28**
Colleges	3	.593	.198	.24
G X C	2	.565	.282	.34
Within	128	107.566	.840	
Total	134	129.594		

SEMESTER TWO

Source of Variation	*df*	Sum of Squares	Variance Estimate	*F*
Groups	1	8.894	8.894	11.69**
Colleges	3	3.714	1.238	1.63
G X C	2	.031	.015	.02
Within	104	79.149	.761	
Total	110	101.736		

TABLE LIII (Continued)

SEMESTER THREE

Source of Variation	*df*	Sum of Squares	Variance Estimate	*F*
Groups	1	.155	.155	.22
Colleges	3	7.557	2.519	3.55*
G X C	3	5.241	1.747	2.46
Within	64	45.405	.709	
Total	71	58.982		

SEMESTER FOUR

Source of Variation	*df*	Sum of Squares	Variance Estimate	*F*
Groups	1	.674	.674	1.13
Colleges	3	1.773	.591	.99
G X C	3	1.758	.586	.98
Within	51	30.429	.597	
Total	58	37.677		

TABLE LIII (Continued)

SEMESTER FIVE

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.860	.860	1.84
Colleges	3	1.863	.621	1.33
G X C	3	2.230	.743	1.59
Within	33	15.457	.468	
Total	40	25.568		

SEMESTER SIX

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.158	.158	.37
Colleges	3	3.575	1.192	2.78
G X C	3	3.197	1.066	2.48
Within	31	13.308	.429	
Total	38	19.889		

TABLE LIII (Continued)

SEMESTER SEVEN

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.026	.026	.09
Colleges	2	1.765	.882	2.98
G X C	1	1.253	1.253	4.24*
Within	25	7.391	.296	
Total	29	10.512		

SEMESTER EIGHT

Source of Variation	df	Sum of Squares	Variance Estimate	F
Groups	1	.016	.016	.06
Colleges	2	.755	.377	1.34
G X C	1	.090	.090	.32
Within	19	5.346	.281	
Total	23	6.293		

* Significant at .05
** Significant at .01

APPENDIX D

TABLE OF CELL NUMBERS

TABLE LIV

TABLE OF CELL NUMBERS FOR SEMESTERS ONE THROUGH EIGHT BY GROUP, COLLEGE, AND SEX

	AG	A&S	ENGR.	T. ED.	BA	TOTAL
			SEMESTER I			
Total Group						
Group A	21	91	84	24	8	228
Group B	69	73	33	32	19	226
College Total	90	164	117	56	27	454
Males Only						
Group A	18	61	83	11	8	181
Group B	52	38	32	9	7	138
College Total	70	99	115	20	15	319
Females Only						
Group A	3	30	1	13	-	47
Group B	17	35	1	23	12	88
College Total	20	65	2	36	12	135
			SEMESTER II			
Total Group						
Group A	20	82	75	21	6	204
Group B	49	57	24	21	16	167
College Total	69	139	99	42	22	371
Males Only						
Group A	16	55	74	10	6	161
Group B	35	29	24	3	8	99
College Total	51	84	98	13	14	260
Females Only						
Group A	4	27	1	11	-	43
Group B	14	28	-	18	8	68
College Total	18	55	1	29	8	111

TABLE LIV (Continued)

	AG	A&S	ENGR.	T. ED.	BA	TOTAL
			SEMESTER III			
Total Group						
Group A	15	63	62	22	3	165
Group B	33	33	18	11	7	102
College Total	48	96	80	33	10	267
Males Only						
Group A	13	43	62	11	2	131
Group B	23	16	18	2	5	64
College Total	36	59	80	13	7	195
Females Only						
Group A	2	20	-	11	1	34
Group B	10	17	-	9	2	38
College Total	12	37	-	20	3	72
			SEMESTER IV			
Total Group						
Group A	13	49	54	20	7	143
Group B	26	21	14	10	7	78
College Total	39	70	68	30	14	221
Males Only						
Group A	12	32	54	10	5	113
Group B	19	8	14	3	5	49
College Total	31	40	68	13	10	162
Females Only						
Group A	1	17	-	10	2	30
Group B	7	13	-	7	2	29
College Total	8	30	-	17	4	59

TABLE LIV (Continued)

	AG	A&S	ENGR.	T. ED.	BA	TOTAL
			SEMESTER V			
Total Group						
Group A	7	38	43	18	8	114
Group B	24	5	11	9	8	57
College Total	31	43	54	27	16	171
Males Only						
Group A	6	25	43	10	7	91
Group B	18	2	11	3	5	39
College Total	24	27	54	13	12	130
Females Only						
Group A	1	13	-	8	1	23
Group B	6	3	-	6	3	18
College Total	7	16	-	14	4	41
			SEMESTER VI			
Total Group						
Group A	6	33	31	15	7	92
Group B	23	5	8	8	6	50
College Total	29	38	39	23	13	142
Males Only						
Group A	5	21	31	8	6	71
Group B	17	2	8	2	3	32
College Total	22	23	39	10	9	103
Females Only						
Group A	1	12	-	7	1	21
Group B	6	3	-	6	3	18
College Total	7	15	-	13	4	39

TABLE LIV (Continued)

	AG	A&S	ENGR.	T. ED.	BA.	TOTAL
			SEMESTER VII			
Total Group						
Group A	6	26	25	17	7	81
Group B	16	1	4	6	1	28
College Total	22	27	29	23	8	109
Males Only						
Group A	5	15	25	10	6	61
Group B	12	-	4	1	1	18
College Total	17	15	29	11	7	79
Females Only						
Group A	1	11	-	7	1	20
Group B	4	1	-	5	-	10
College Total	5	12	-	12	1	30
			SEMESTER VIII			
Total Group						
Group A	6	20	14	11	5	56
Group B	12	-	3	3	1	19
College Total	18	20	17	14	6	75
Males Only						
Group A	5	10	14	6	4	39
Group B	8	-	3	-	1	12
College Total	13	10	17	6	5	51
Females Only						
Group A	1	10	-	5	1	17
Group B	4	-	-	3	-	7
College Total	5	10	-	8	1	24

END